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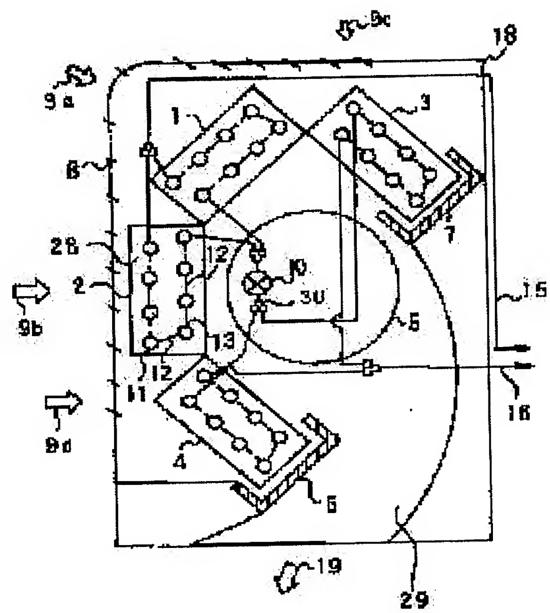
(54) AIR CONDITIONER

(57)Abstract:
PROBLEM TO BE SOLVED: To solve the problem of a conventional air conditioner, such as there being unevenness of temperature between heated air and dehumidified and cooled air, in reheating humidifying operation.
SOLUTION: In an air conditioner where an indoor heat exchanger is arranged to surround a blower 5 from the front of an indoor unit to the rear, the indoor unit is divided, and a second flow control valve 10 is provided between them. Also a refrigerant passage is constituted such that a reheater 25 and an evaporator 27 are thermally broken off in operation mode, so as to make the upstream side of the refrigerant flow of this second flow control valve work as the reheater 25 and make the downstream side of the refrigerant flow work as the evaporator 27, and that the right front section 2 or the front upper stage slant section 1 of the indoor heat exchanger works as the reheater 25 and the front lower stage section 4 or the rear lower stage section of the indoor heat exchanger works as the evaporator 27.



* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]In an air conditioner arranged so that it may have a compressor, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger, indoor heat exchanger may be applied to the back from a front face of an interior unit and a fan may be surrounded, While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, While this reheater and evaporator are thermally intercepted in a reheater and the refrigerant flow downstream in the mode of operation operated as an evaporator, the refrigerant flow upstream of this 2nd flow control valve, An air conditioner constituting a refrigerant passage on which a transverse plane of said indoor heat exchanger or a front upper row slanting portion is made to act on as a reheater, and a front lower-berth portion and a back portion of said indoor heat exchanger are made to act as an evaporator.
[Claim 2]The air conditioner comprising according to claim 1:
A drain pan for front lower-berth partial heat exchangers which collects dew which was transmitted to it and dehumidified a front lower-berth portion of said indoor heat exchanger.
A drain pan for back heat exchangers which collects dew which was transmitted to it and dehumidified a back portion of said indoor heat exchanger.

[Claim 3]In an air conditioner which was provided with a compressor, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger, and was provided with an air-drawing grill which it arranges so that indoor heat exchanger may be applied to the back from a front face of an interior unit and a fan may be surrounded, and inhales air from a front face and the upper surface, While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, While this reheater and evaporator are thermally intercepted in a reheater and the refrigerant flow downstream in the mode of operation operated as an evaporator, the refrigerant flow upstream of this 2nd flow control valve, A refrigerant passage on which a back portion of said indoor heat exchanger is made to act on as an evaporator, and a front slanting portion of said indoor heat exchanger located next to a back portion of this indoor heat exchanger is made to act as a reheater is constituted, And an air conditioner provided with a drain pan for back heat exchangers which collects dew which was transmitted to it and dehumidified a back portion of said indoor heat exchanger.
[Claim 4]The air conditioner according to claim 1 or 3 having arranged refrigerant inflow piping to said reheater to the upstream of a suction air flow to indoor heat exchanger, and having arranged refrigerant inflow piping to said evaporator to the upstream of a suction air flow to indoor heat exchanger.
[Claim 5]Any of claims 1 thru/or 4 unifying a reheater of said indoor heat exchanger, or an air conditioner of a statement.
[Claim 6]Any of claims 1 thru/or 5 having arranged said indoor heat exchanger circularly, or an air conditioner of a statement.
[Claim 7]While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, Any of claims 1 thru/or 6 provided with an auxiliary heat exchanger thermally intercepted [downstream / a reheater and / refrigerant flow] by the refrigerant flow upstream of a reheater in the refrigerant flow upstream of this 2nd flow control valve at the time of the mode of operation operated as an evaporator, or an air conditioner of a statement.
[Claim 8]The air conditioner according to claim 7 installing said auxiliary heat exchanger in the air flow windward of said reheater.
[Claim 9]The air conditioner according to claim 7 or 8 making a draft resistance of said auxiliary heat exchanger smaller than other heat exchangers.
[Claim 10]Any of claims 1 thru/or 9 using R410A, or R32 or R290 as a refrigerant, or an air conditioner of a statement.
[Claim 11]Any of claims 7 thru/or 9 making a refrigerant passage of an auxiliary heat exchanger into one line using R410A, or R32 or R290 as a refrigerant, or an air conditioner of a statement.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]In the air conditioner which uses the heat of condensation of a refrigerating cycle as a source of heating to indoor air, this invention relates to the air conditioner which improves the controllability of temperature and humidity.
[0002]
[Description of the Prior Art]it resembles the conventional air conditioner, it sets, a number-of-rotations good transformation compressor etc. are mainly used, and change of air conditioning load is supported. However, although compressor number of rotations fell, at the time of air conditioning feebleminded power operation, evaporating temperature also rose, and it became more than the dew-point temperature of indoor air, and it had the problem that it could not dehumidify.
[0003]As conventional technology which raises the dehumidification capacity at the time of air conditioning feebleminded power operation, there is an air conditioner shown in drawing 24 of JP,9-42706,A. In the air conditioner arranged so that according to this device it may have a compressor, a four-way valve, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger, indoor heat exchanger may be applied to the back from the front face of an interior unit and a fan may be surrounded, While dividing said indoor heat exchanger thermally and forming the 2nd flow control valve 10 between them, dehumidification capacity is secured in the mode of operation as for which the refrigerant flow upstream of this 2nd flow control valve 10 operates a reheater and the refrigerant flow downstream as an evaporator. At this time, the heat exchanger installed in the back from the front upper row is acting as a reheater.
[0004]As other conventional technologies, there is an air conditioner shown in drawing 25 of JP,10-89803,A. In the air conditioner arranged so that it may have a compressor, a four-way valve, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger, indoor heat exchanger may be applied to the back from the front face of an interior unit and a fan may be surrounded, While dividing said indoor heat exchanger thermally and forming the 2nd flow control valve 10 between them, While having the mode of operation as for which the refrigerant flow upstream of this 2nd flow control valve 10 operates a reheater and the refrigerant flow downstream as an evaporator, the auxiliary heat exchanger 14 was installed in the refrigerant flow upstream of a reheater at this time, and dehumidification capacity is secured.
[0005]
[Problem(s) to be Solved by the Invention]However, in JP,9-42706,A or JP,10-89803,A, since it is installed in the place with the back heat exchangers near a wall surface, there is a problem that air breathing resistance is strong and there is little passing air quantity of back heat exchangers. Therefore, there is a problem that there are few suction air flow rates in the back heat exchangers used as a reheater, and reheat heat exchanging quantity cannot be secured.

Since there are few suction air flow rates in back heat exchangers, the air heated through the reheater passes the front heat exchanger used as an evaporator, and is not well mixed with the air by which dehumidification cooling was carried out, but temperature unevenness arises to blow-off air, and it becomes an amenity top problem. If it contacts while the air of the low temperature which passed the evaporator has not been mixed with the reheated hot air, dew will occur, and there is a problem on the reliability of being dropped from an air port as it is, without dew reaching a drain pan. While the mixed degree has been in a low state, when a fan is passed, when mixed by a fan, dew occurs, it adheres to a fan and there is a problem on the reliability of being dropped from an air port as it is. If the heated air and the air by which dehumidification cooling was carried out are not mixed well, a low-temperature portion produces an air course wall surface etc. locally, dew occurs also here, and there is a problem on the reliability of being dropped from an air port as it is.

[0006]Although R22 was used as a refrigerant in the conventional air conditioner, since it is prevention from ozone layer depletion, substitution-ization to R410A etc. is advancing. Since working pressure becomes high from R22, the problem that the differential pressure in the 2nd flow control valve also becomes large, and a refrigerant flow sound becomes larger produces R410A.

[0007]This invention is made in order to solve a problem which was described above, and in the air conditioner which uses the heat of condensation of a refrigerating cycle as a source of heating to indoor air, an object of this invention is to improve the controllability of temperature and humidity.

[0008]

[Means for Solving the Problem]In an air conditioner arranged so that an air conditioner concerning this invention may be provided with a compressor, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger, indoor heat exchanger may be applied to the back from a front face of an interior unit and a fan may be surrounded, While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, While this reheater and evaporator are thermally intercepted in a reheater and the refrigerant flow downstream in the mode of operation operated as an evaporator, the refrigerant flow upstream of this 2nd flow control valve, A refrigerant passage on which a transverse plane of said indoor heat exchanger or a front upper row slanting portion is made to act on as a reheater, and a front lower-berth portion and a back portion of said indoor heat exchanger are made to act as an evaporator is constituted.

[0009]It has a drain pan for front lower-berth partial heat exchangers which collects dew which was transmitted to it and dehumidified a front lower-berth portion of said indoor heat exchanger, and a drain pan for back heat exchangers which collects dew which was transmitted to it and dehumidified a back portion of said indoor heat exchanger.

[0010]It has a compressor, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger, In an air conditioner provided with an air-drawing grill which it arranges so that indoor heat exchanger may be applied to the back from a front face of an interior unit and a fan may be surrounded, and inhales air from a front face and the upper surface, While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, While this reheater and evaporator are thermally intercepted in a reheater and the refrigerant flow downstream in the mode of operation operated as an evaporator, the refrigerant flow upstream of this 2nd flow control valve, A refrigerant passage on which a back portion of said indoor heat exchanger is made to act on as an evaporator, and a front slanting portion of said indoor heat exchanger located next to a back portion of this indoor heat exchanger is made to act as a reheater is constituted, And it has a drain pan for back heat exchangers which collects dew which was transmitted to it and dehumidified a back portion of said indoor heat exchanger.

[0011]Refrigerant inflow piping to said reheater is arranged to the upstream of a suction air flow to indoor heat exchanger, and refrigerant inflow piping to said evaporator is arranged to the upstream of a suction air flow to indoor heat exchanger.

[0012]A reheater of said indoor heat exchanger is unified.

[0013]Said indoor heat exchanger is arranged circularly.

[0014]While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, it has an auxiliary heat exchanger thermally intercepted [downstream / a reheater and / refrigerant flow] by the refrigerant flow upstream of a reheater in the refrigerant flow upstream of this 2nd flow control valve at the time of the mode of operation operated as an evaporator.
[0015]Said auxiliary heat exchanger is installed in the air flow windward of said reheater.
[0016]A draft resistance of said auxiliary heat exchanger is made smaller than other heat exchangers.
[0017]R410A, or R32 or R290 is used as a refrigerant.
[0018]A refrigerant passage of an auxiliary heat exchanger is made into one line, using R410A, or R32 or R290 as a refrigerant.
[0019]
[Embodiment of the Invention]The air conditioner by a 1st embodiment of embodiment 1. this invention is shown in drawing 1 and 2. Drawing 1 is a sectional view of an indoor unit, and drawing 2 is a refrigerant circuit figure. In drawing 1, the indoor heat exchanger incorporated in the indoor unit has multi stage bending structure for example, by the plate fin tube type heat exchanger, it was installed so that it might apply to the back from a front face and the fan 5 (the example of a flowing-through fan is shown) might be surrounded, and it is provided with the 2nd flow control valve 10. As for a heat exchanger tube and 12, the heat exchanger tube connected piping by the side of the back and 28 are heat transfer fins the heat exchanger tube connected piping of a near side, and 13 11. This indoor heat exchanger is the four-step bending structure of the front lower-berth portion 4, the front front part 2, the front upper row slanting portion 1, and the back portion 3, and each portion is intercepted thermally.As for an air-drawing grill and 9, the drain pan for front lower-berth partial heat exchangers and 7 are [an air port and 19] blow-off air flowing directions a suction air flowing direction and 29 the drain pan for back heat exchangers, and 8 6. The air inhaled from the air-drawing grill 8 from the direction of 9, it is drawn in by the fan 5, heat exchange is carried out through four each of the front upper row slanting portions 1 and 9c to the back portion 3 from the front front part 2 and 9a from the front lower-berth portions 4 and 9b from 9d of suction air flowing directions, and it blows off from the air port 29 in the direction of 19. In the refrigerant circuit figure shown in drawing 2, the outdoor unit 17, Comprising the compressor 21, the four-way valve 22, the outdoor heat exchanger 23, and the 1st flow control valve 24, the indoor heat exchanger of the indoor unit 18 comprised the 1st indoor heat exchanger 25 and the 2nd indoor heat exchanger 27 which were divided thermally, and has formed the 2nd flow control valve 10 between them. In the path pattern of the indoor heat exchanger shown in drawing 1. When the four-way valve 22 shown in drawing 2 becomes the direction of [at the time of air conditioning reheat dehumidifying operation], at the time of the arrow direction of a solid line, refrigerant inlet piping is set to 15, refrigerant exit piping is set to 16, and the refrigerant flow direction shows the example connected to the 1st flow control valve 24 in drawing 2, and the four-way valve 22, respectively. The 1st indoor heat exchanger 25 of the indoor heat exchanger used as a reheater, The 2nd indoor heat exchanger 27 of the indoor heat exchanger which is arranged at the front upper row slanting portion 1 and the front front part 2 used as the refrigerant flow upstream of the 2nd flow control valve, and turns into an evaporator, It has the structure where it has been arranged at the back portion 3 and the front lower-berth portion 4 used as the refrigerant flow downstream of the 2nd flow control valve, and the reheater has been arranged also at the evaporator bottom. In the above, in an operation of the indoor unit 18 of drawing 1, and the refrigerant circuit of drawing 2, the operation at the time of air conditioning reheat dehumidifying operation is explained below.
[0020]In drawing 2, the 2nd flow control valve 10 is considered as full admission at the time of cooling operation, and it usually serves as a refrigerating cycle decompressed by the 1st flow control valve 24. On the other hand, the opening of the 1st flow control valve 24 is opened at the time of air conditioning reheat dehumidifying operation, it makes it feeling, and serves as a refrigerating cycle which uses the 2nd flow control valve 10 as a main pressure reducing device. The pressure-enthalpy diagram in the refrigerating cycle at the time of this air conditioning reheat dehumidifying operation is shown in drawing 3. A-F in drawing 3 corresponds to A-F in the refrigerant circuit in drawing 2, respectively, and shows the refrigerant flow direction at the

time of air conditioning reheat dehumidifying operation by the arrow of the solid line in drawing 2. The refrigerant which was breathed out from the compressor 21 and passed along the four-way valve 22 is condensed by the outdoor heat exchanger 23 from an A point, serves as a B point, is decompressed a little by the 1st flow control valve 24, serves as C point, and flows into the 1st indoor heat exchanger 25. At this time, the 1st indoor heat exchanger 25 acts as a reheater, and is re-condensed to D point. It is decompressed to E point through the 2nd flow control valve 10 after this, and flows into the 2nd indoor heat exchanger 27. At this time, the 2nd indoor heat exchanger 27 acts as an evaporator, evaporates to F point, and serves as a refrigerating cycle which returns to inhalation of the compressor 21. At this time, the air by which cooling dehumidification was carried out, and the air heated by the 1st indoor heat exchanger 25 mix and blow off by the 2nd indoor heat exchanger 27 with the indoor unit 18. Therefore, it can dehumidify at the time of this air conditioning reheat dehumidifying operation, preventing the fall of a room temperature.

[0021]At the time of the reheat dehumidifying operation mentioned above, as shown in drawing 1, the 1st indoor heat exchanger 25 used as a reheater, It is arranged so that the fan 5 may be surrounded to the front upper row slanting portion 1 and the front front part 2 used as the refrigerant flow upstream of the 2nd flow control valve, Since the 2nd indoor heat exchanger 27 of the indoor heat exchanger used as an evaporator is arranged so that the fan 5 may be surrounded into the back portion 3 and the front lower-berth portion 4 used as the refrigerant flow downstream of the 2nd flow control valve, The air inhaled and heated from the slanting upper surface 9a and the front face 9b of the indoor unit 18 and the air by which cooling dehumidification was carried out from the back 9c or the front lower part 9d are efficiently mixed by the fan 5. Especially as compared with a conventional example, by making the back portion 3 act as an evaporator, the back portion 3 is passed and the air 9c by which dehumidification cooling was carried out, and the air 9a which passed the front upper row slanting portion 1, and was heated are mixed especially well. Therefore, since the air 19 which blows off from the outlet 29 turns into air which there is no temperature fall and was dehumidified as compared with suction air, and there is moreover no temperature unevenness in air and it blows off, it can make very comfortable indoor environment.

[0022]Since the heated air 9a and 9b and the air 9c and 9d by which cooling dehumidification was carried out are efficiently mixed by the fan 5, Temperature unevenness is lost on the fan 5, the wall surface of the outlet 29, etc., dew adheres to the portion cooled locally, and the problem on reliability that dew will blow off from the outlet 29 with blow-off air can be canceled. Since the air 9c and 9d by which cooling dehumidification was carried out from the both sides of the heated air 9a and 9b is mixed, Mixing of air can carry out at two places, when the big lumps of air like before by which cooling dehumidification was carried out, and the heated air contact, dew occurs in the interface and the problem on reliability that dew will blow off from the outlet 29 with blow-off air can also be canceled.

[0023]Since the 2nd indoor heat exchanger 27 of the indoor heat exchanger used as an evaporator is arranged so that the fan 5 may be surrounded into the back portion 3 and the front lower-berth portion 4, and the drain pans 6 and 7 are installed in each heat exchanger lower part, Without dew blowing off from the outlet 29 with blow-off air, Since the drain pans 6 and 7 can recover directly the dew which was transmitted to them and dehumidified the heat exchangers 3 and 4, without the 1st indoor heat exchanger 25 receiving open dropping generated from the 2nd indoor heat exchanger, reliability is securable.

[0024]The arrow of a dotted line shows the refrigerant flow direction at the time of heating operation to drawing 2. The pressure-enthalpy diagram in the refrigerating cycle in heating dehumidifying operation is shown in drawing 4. A-F in drawing 4 corresponds to A-F in the refrigerant circuit in drawing 2, respectively. The refrigerant which was breathed out from the compressor 21 and passed along the four-way valve 22 is condensed by the 2nd indoor heat exchanger 27 from F point, serves as E point, is decompressed by the 2nd flow control valve 10, serves as D point, and flows into the 1st indoor heat exchanger 25. At this time, the 2nd indoor heat exchanger 27 acts as a reheater, and the 1st indoor heat exchanger 25 acts as an evaporator. It flows into the 1st flow control valve 24 through C point after this, and it is

decompressed till a B point and flows into the outdoor heat exchanger 23. And it re-evaporates till an A point and becomes a refrigerating cycle which returns to inhalation of the compressor 21. At this time, the air by which cooling dehumidification was carried out, and the air heated by the 2nd indoor heat exchanger 27 mix and blow off by the 1st indoor heat exchanger 25 with the indoor unit 18. Therefore, it can operate, also dehumidifying this heating period.

[0025]The air conditioner used as other examples by a 1st embodiment of this invention is shown in drawing 5. Drawing 5 is a sectional view of an indoor unit, the sign is the same as that of drawing 1, and the refrigerant circuit of it is the same as that of drawing 2. Although the 1st indoor heat exchanger 25 used as the reheater in drawing 1 is arranged at the front upper row slanting portion 1 and the front front part 2 used as the refrigerant flow upstream of the 2nd flow control valve, in drawing 5, it unified this as a reheater and has really arranged it into the front slanting portion 2. The 2nd indoor heat exchanger 27 used as an evaporator is arranged at the back portion 3 and the front lower-berth portion 4 which serve as the refrigerant flow downstream of the 2nd flow control valve like drawing 1. Therefore, by having unified the reheater, low cost-ization can be attained from drawing 1. Indoor heat exchanger is arranged circularly or it is considered as the multi stage bending structure further divided into a large number from drawing 1, and if it devises putting slitting into the heat transfer fin 28 of the interstage of the heat exchanger tube 11, and preventing heat conduction in a fin etc. for example, it intercepts between a reheater and evaporators thermally, the purpose of this invention will be attained.

[0026]Furthermore it is based on a 1st embodiment of this invention, the air conditioner used as other examples is shown in drawing 6. Drawing 6 is a sectional view of an indoor unit, the sign is the same as that of drawing 1, and the refrigerant circuit of it is the same as that of drawing 2. An example with equal heat exchanger capacity of the 2nd indoor heat exchanger 27 used as the heat exchanger capacity of the 1st indoor heat exchanger 25 that turns into a reheater in drawing 1, and an evaporator, Namely, although the example constituted from the front lower-berth portion 4, the front front part 2, the front upper row slanting portion 1, the back portion 3, and four steps of two-row plate finned tube heat exchangers was shown, The example from which the heat exchanger capacity of the 2nd indoor heat exchanger 27 that turns into heat exchanger capacity of the 1st indoor heat exchanger 25 used as a reheater and an evaporator in drawing 6 differs, That is, as for the front lower-berth portion 4, two-row four steps and the front upper row slanting portion 1 were constituted from five steps two-row, and the back portion 3 constituted two-row three steps and the front front part 2 from a plate finned tube heat exchanger of two-row four-step **. Even if it changes the ratio of reheater heat exchanging quantity to evaporation heat exchange quantity according to the indoor latent heat sensible heat load assumed by having composition as shown in drawing 6, it can dehumidify at the time of air conditioning reheat dehumidifying operation, preventing the fall of a room temperature. According to change of indoor latent heat sensible heat load, the ratio of reheater heat exchanging quantity to evaporation heat exchange quantity may be changed by the device of the composition of refrigerant passages, such as introduction of a path pattern variable actuator.

[0027]The sectional view of the indoor unit of the air conditioner by a 2nd embodiment of embodiment 2. this invention is shown in drawing 7. The sign is the same as drawing 1, and the refrigerant circuit of this air conditioner is the same as that of drawing 2. The indoor heat exchanger of drawing 7 has multi stage bending structure, for example by the plate fin tube type heat exchanger, it was installed so that it might apply to the back from a front face and the fan 5 might be surrounded, and it equips the indoor unit with the 2nd flow control valve 10. The indoor heat exchanger shown in drawing 7 is an example of four-step bending structure, and each portion is intercepted thermally. The path pattern and refrigerant flow direction of indoor heat exchanger show the case at the time of air conditioning reheat dehumidifying operation. The 1st indoor heat exchanger 25 from which the 2nd indoor heat exchanger 27 that turns into an evaporator at this time turns into the back portion 3, the front lower-berth portion 4, and a reheater is the front front part 2 and the front upper row slanting portion 1. And it has the auxiliary heat exchanger 14 thermally intercepted by the refrigerant flow upstream of the heat

exchanger used as a reheater in the case of air conditioning reheat dehumidifying operation. In operation of the above indoor unit 18 of drawing 7, and the refrigerant circuit of drawing 2, the operation at the time of air conditioning reheat dehumidifying operation is explained below.
[0028]Like a 1st embodiment, in drawing 2, the 2nd flow control valve 10 is considered as full admission at the time of cooling operation, and it usually serves as a refrigerating cycle decompressed by the 1st flow control valve 24 also in a 2nd embodiment. On the other hand, the 1st flow control valve 24 is opened at the time of air conditioning reheat dehumidifying operation, it makes it feeling, and serves as a refrigerating cycle which uses the 2nd flow control valve 10 as a main pressure reducing device. The pressure-enthalpy diagram in the refrigerating cycle at the time of this air conditioning reheat dehumidifying operation also serves as the same drawing 3 as a 1st embodiment. The refrigerating cycle in heating dehumidifying operation becomes being the same as that of a 1st embodiment.
[0029]If the capacity of the heat exchanger which generally turns into a reheater is set up greatly, reheat heat exchanging quantity can be enlarged, and the capacity control range which carries out reheat dehumidification can be enlarged, preventing a room temperature fall. Therefore, in this example, it becomes possible to enlarge the capacity control range which carries out reheat dehumidification, reheat heat exchanger capacity being expanded, and reheat heat exchanging quantity increasing, and preventing a room temperature fall by having equipped the refrigerant flow upstream used as a reheater with the auxiliary heat exchanger 14 at the time of air conditioning reheat dehumidifying operation. If reheat heat exchanger capacity is only expanded, indoor unit 18 size will become large, but if it installs like this example, the opening space in the indoor unit 18 can be utilized effectively, and miniaturization of the indoor unit 18 will also be attained.
[0030]The 2nd indoor heat exchanger 27 of the indoor heat exchanger which turns into an evaporator like a 1st embodiment in this example, Since it is arranged so that the fan 5 may be surrounded into the back portion 3 and the front lower-berth portion 4 used as the refrigerant flow downstream of the 2nd flow control valve, The air by which suction heating was carried out from the front slant 9a and the transverse plane 9b of the indoor unit 18, and the air by which cooling dehumidification was inhaled and carried out from the back 9c or the front lower part 9d are efficiently mixed by the fan 5. Especially as compared with a conventional example, by making the back portion 3 act as an evaporator, the back portion 3 is passed and the air 9c by which dehumidification cooling was carried out, and the air 9a which passed the front upper row slanting portion 1, and was heated are mixed especially well. Therefore, since the air 19 which blows off from the outlet 29 turns into air which there is no temperature fall and was dehumidified as compared with suction air, and there is moreover no temperature unevenness in air and it blows off, it can make very comfortable indoor environment.
[0031]Since the air by which cooling dehumidification was carried out, and the heated air are efficiently mixed by the fan 5, Temperature unevenness is lost on the fan 5, the wall surface of the outlet 29, etc., dew adheres to the portion cooled locally, and the problem on reliability that dew will blow off from the outlet 29 with blow-off air can be canceled. When the air by which cooling dehumidification was carried out, and the heated air contact, dew occurs in the interface and the problem on reliability that dew will blow off from the outlet 29 with blow-off air can also be canceled.
[0032]Since the 2nd indoor heat exchanger 27 of the indoor heat exchanger used as an evaporator is arranged so that the fan 5 may be surrounded into the back portion 3 and the front lower-berth portion 4, and the drain pans 6 and 7 are installed in each heat exchanger lower part, Since the dew which was transmitted to it and dehumidified the heat exchanger can be collected directly, without dew blowing off from the outlet 29 with blow-off air, reliability is securable.
[0033]In this example, since the passage wind speed equips the air flow 9a upstream of front upper row slanting partial 1 largest heat exchanger with the auxiliary heat exchanger 14, reheat heat exchanger capacity is expanded more and reheat heat exchanging quantity increases, and it becomes possible to enlarge the capacity control range which carries out reheat dehumidification, preventing a room temperature fall.

[0034]When the auxiliary heat exchanger 14 is installed in the air flow upstream of the heat exchanger which acts as evaporators, such as back partial 3 heat exchanger, the heated air will be cooled, the system efficiency of an air conditioner falls, and it is not a best policy. When the auxiliary heat exchanger 14 is installed in the air flow upstream of front front part 2 heat exchanger, the depth size of the indoor unit 18 increases, and it moves against miniaturization of the indoor unit 18, and is not a best policy. When it installs in the air flow upstream of front lower-berth partial 4 heat exchanger similarly, in order that front lower-berth partial 4 heat exchanger may act as an evaporator, the heated air will be cooled, the system efficiency of an air conditioner falls, and it is not a best policy.
[0035]Next, the operation at the time of the usual heating operation in this example is explained. Although indoor heat exchanger turns into a condenser at the time of heating operation, it is necessary to fully take the refrigerant supercooling degree in a condenser outlet, in order to raise heat-of-condensation exchange quantity, and to expand refrigerant enthalpy. However, its refrigerant temperature is also lower than condensation temperature in a supercooling region while a refrigerant is a liquid condition. For this reason, while raising the refrigerant rate of flow in a heat exchanger tube and raising refrigerant heat transmissibility, it is necessary to install the heat exchanger tube in a supercooling region in the windward of an air flow, to carry out heat exchange to the air with a comparatively low temperature before heat exchange, and to aim at improvement in heat-of-condensation exchange quantity in a supercooling region. It is necessary to reduce the quantity of heat which carries out heat conduction of the heat transfer fin, and does not contribute it to the air conditioning which carries out heat exchange by intercepting a supercooling portion thermally with a saturation portion. It is necessary to do heat exchanger tube arrangement in the high temperature gas refrigerant region of a condenser entrance as air and a countercurrent flow. In drawing 7, the auxiliary heat exchanger 14 is installed in the portion which serves as an outlet side of a condenser at the time of heating operation, and is installed in the air flow upstream of front upper row slanting partial 1 heat exchanger, and makes the refrigerant passage one line. Therefore, as mentioned above, refrigerant heat transmissibility can fully become high early, the refrigerant rate of flow in a heat exchanger tube can also fully take a temperature gradient with air, and performance sufficient as supercooling heat exchanger can be demonstrated. Since the auxiliary heat exchanger 14 was used as front upper row slanting partial 1 heat exchanger with the different body, was intercepted thermally and installed, the quantity of heat which carries out heat conduction of between the heat transfer fins 28, and does not contribute it to the air conditioning which carries out heat exchange can be reduced, and heat exchanging performance can be raised. Piping into which the high temperature gas refrigerant which serves as a condenser entrance in drawing 7 at the time of heating operation flows is installed in the downstream of an air flow, and since it counters with air with a low temperature and is flowing, heat exchanging performance can be raised more.
[0036]Although drawing 7 showed the case where the number of the refrigerant passages in the high temperature gas refrigerant in which the refrigerant passage of the auxiliary heat exchanger 14 used as supercooling heat exchanger serves as a condenser entrance by one line was two, The number of passes should be set as the optimum value so that the effect given to heat exchanging performance may serve as the maximum in view of refrigerant heat transmissibility and refrigerant pressure loss also including cooling operation, and the number of passes is set up mainly according to the diameter of a heat exchanger tube.
[0037]Although the passage wind speed has arranged the auxiliary heat exchanger 14 in this example to the air flow 9a upstream of front upper row slanting partial 1 largest heat exchanger, since a draft resistance has a possibility that may increase and air capacity may fall, a draft resistance needs to use the auxiliary heat exchanger 14 as a small thing. That is, the fin pitch of a heat transfer fin may be expanded, heat transfer fin width may be made small, it may be made the specification which does not perform the heat transfer fin end lifting provided in order to raise heat transfer performance to indoor heat exchanger, or the diameter of a heat exchanger tube may be made thinner than indoor heat exchanger.
[0038]The air conditioner used as other examples by a 2nd embodiment of this invention is shown in drawing 8. Drawing 8 is a sectional view of an indoor unit, the sign is the same as that

of drawing 7, and the refrigerant circuit of it is the same as that of drawing 2. Although the 1st indoor heat exchanger 25 used as the reheater in drawing 8 is arranged at the front upper row slanting portion 1 and the front front part 2 used as the refrigerant flow upstream of the 2nd flow control valve, In drawing 8, this was unified as a reheater, it has really arranged into the front slanting portion 2, and the auxiliary heat exchanger 14 was installed in the air flow upstream. The 2nd indoor heat exchanger 27 used as an evaporator is arranged at the back portion 3 and the front lower-berth portion 4 which serve as the refrigerant flow downstream of the 2nd flow control valve like drawing 7. Therefore, by having unified the heat exchanger used as a reheater, low cost-ization can be attained from drawing 7. Indoor heat exchanger is arranged circularly or it is considered as the multi stage bending structure further divided into a large number from drawing 7, and if it devises putting slitting into the heat transfer fin 28 of the interstage of the heat exchanger tube 11, and preventing heat conduction in a fin etc. for example, it intercepts between a reheater and evaporators thermally, the purpose of this invention will be attained.

[0039]Furthermore it is based on a 2nd embodiment of this invention, the air conditioner used as other examples is shown in drawing 9. Drawing 9 is a sectional view of an indoor unit, the sign is the same as that of drawing 8, and the refrigerant circuit of it is the same as that of drawing 2. The example from which the heat exchanger capacity of the 2nd indoor heat exchanger 27 used as the heat exchanger capacity of the 1st indoor heat exchanger 25 that adds the auxiliary heat exchanger 14 and turns into a reheater in drawing 9, and an evaporator differs, That is, as for the front lower-berth portion 4, two-row four steps and the front upper row slanting portion 1 were constituted from five steps two-row, and the back portion 3 constituted two-row three steps and the front front part 2 from a plate finned tube heat exchanger of two-row four-step **. Even if it changes the ratio of reheater heat exchanging quantity to evaporation heat exchange quantity according to the indoor latent heat sensible heat load assumed by having composition as shown in drawing 9, it can dehumidify at the time of air conditioning reheat dehumidifying operation, preventing the fall of a room temperature. According to change of indoor latent heat sensible heat load, the ratio of reheater heat exchanging quantity to evaporation heat exchange quantity may be changed by the device of the composition of refrigerant passages, such as introduction of a path pattern variable actuator.

[0040]As mentioned above, in the indoor unit 18 stated to the 1st and 2 embodiment, although the example using all indoor heat exchangers as a reheater or an evaporator was shown, Only some heat exchangers of hyperfractionation structure are used by composition of a refrigerant passage, and even if it makes it act as a reheater or an evaporator, the dehumidified air without a room temperature fall can be blown off. However, the fault that the capacity control range becomes narrow exists, and it is not suitable.

[0041]The feature at the time of using R410A, R32, or R290 as a refrigerant used for the air conditioner stated to the 1st and 2 embodiment is explained above. To R22 refrigerant conventionally used for the air conditioner, the ozone destruction coefficient ofRR410 290 [R32 / A] refrigerant is 0, the global warming potential of especially R32 and R290 is also smaller than R22 and R410A, and there is the feature of a refrigerant gentle to earth environment. In addition, R410A, R32, and R290 have the characteristic that a refrigerant pressure loss is small as compared with R22. As for R32, in a refrigerant pressure loss, as compared with R22, a refrigerant pressure loss will be 50% 70% R410A and R290 as compared with R22. Therefore, in R410A, R32, or R290, the temperature gradient of evaporator inlet temperature and outlet temperature becomes small, and has the characteristic that vaporizer temperature is equalized. Therefore, since the air which there is no temperature unevenness in the air by which came out of the evaporator and cooling dehumidification was carried out, it will mix with the heated air very well, and there is no temperature fall, and was dehumidified does not have temperature unevenness and blows off, It can be said that it is the refrigerant which agreed for the purpose of this example that very comfortable indoor environment can be made.

[0042]Although the auxiliary heat exchanger 14 was installed in a 2nd embodiment and the example which constituted the refrigerant passage from one line was shown, Since R410A, R32, and R290 have the characteristic that a refrigerant pressure loss is small as compared with R22,

their heat transfer coefficient improved effect in a refrigerant pipe by the improvement in the refrigerant rate of flow is large, and they can aim at improvement in heat exchanging capacity also in the various modes of operation. Usually, if it has complicated composition, such as distributing an evaporator like a front lower part and the back like drawing 1, and 5, 6 or 7, or forming an auxiliary heat exchanger, heat loss will occur for piping leading about, but. If a refrigerant with a small refrigerant pressure loss is used like the above R410A, R32, or R290, it will become possible to provide comfortable air conditioning environment in the state with little heat loss.

[0043]moreover -- as a refrigerant -- a HFC system (R116, R125, R134a, R14, and R143a.) R152a, R227ea, R23, R236ea, R236fa, R245ca, R245fa, R32, R41, RC318, etc., Several sorts of mixed refrigerants R407A of these refrigerants, R407B, R407C, R407D, R407E, R410B, R404A, R507A, R508A, HC systems (butane, isobutane, ethane, and propane.), such as R508B propylene, etc. several sorts of mixed refrigerants of these refrigerants, and a natural refrigerant (air.) No matter what refrigerants [, such as several sorts of mixed refrigerants, such as carbon dioxide, ammonia, etc. several sorts of mixed refrigerants of these refrigerants and these HFC system, HC system, a natural refrigerant,] it may use, an ozone destruction coefficient is 0, and the effect at the time of the reheat dehumidifying operation stated to the 1st and 2 embodiment is demonstrated.

[0044]The sectional view of the indoor unit of the air conditioner by a 3rd embodiment of embodiment 3. this invention is shown in drawing 10. The sign is the same as drawing 1, and the refrigerant circuit of this air conditioner is the same as that of drawing 2. The indoor heat exchanger of drawing 10 has multi stage bending structure, for example by the plate fin tube type heat exchanger, it was installed so that it might apply to the back from a front face and the fan 5 might be surrounded, and it equips the indoor unit with the 2nd flow control valve 10. The indoor heat exchanger shown in drawing 10 is an example of the four-step bending structure by which the heat exchanger tube has been arranged at two rows. A refrigerant uses R410A or R32. In drawing 10, the path pattern and refrigerant flow direction of indoor heat exchanger show the case at the time of air conditioning reheat dehumidifying operation. The 2nd indoor heat exchanger 27 from which the 1st indoor heat exchanger 25 that turns into a reheater at this time turns into the front front part 2, the front upper row slanting portion 1, and an evaporator is the back portion 3 and the front lower-berth portion 4. In operation of the above indoor unit 18 of drawing 10, and the refrigerant circuit of drawing 2, the operation at the time of air conditioning reheat dehumidifying operation is explained below.

[0045]Like a 1st embodiment, in drawing 2, the 2nd flow control valve 10 is considered as full admission at the time of cooling operation, and it usually serves as a refrigerating cycle decompressed by the 1st flow control valve 24 also in a 3rd embodiment. On the other hand, the 1st flow control valve 24 is considered as full admission at the time of air conditioning reheat dehumidifying operation, and it serves as a refrigerating cycle which uses the 2nd flow control valve 10 as a main pressure reducing device. The pressure-enthalpy diagram in the refrigerating cycle at this time also serves as the same drawing 3 as a 1st embodiment. The refrigerating cycle in heating dehumidifying operation becomes being the same as that of a 1st embodiment.

[0046]How to flow through the refrigerant at the time of the air conditioning reheat dehumidifying operation in drawing 10 and air is explained below. the refrigerant which flowed into indoor heat exchanger from the direction of 15 flowed into front upper row slanting partial 1 heat exchanger used as a reheater -- post branching is carried out, and it flows into the back row side heat exchanger tube of front front part 2 heat exchanger, and the back row side heat exchanger tube of back partial 3 heat exchanger, and operates as a reheater. After this, a refrigerant joins, flows into the 2nd flow control valve 10, is decompressed, flows into the front row side heat exchanger tube of front front part 2 heat exchanger which acts as an evaporator, and the front row side heat exchanger tube of back partial 3 heat exchanger, and flows out of indoor heat exchanger from 16 after flowing into front lower-berth partial 4 heat exchanger. Respectively an air flow passes and carries out heat exchange of each heat exchanger of the front upper row slanting portion 1, the front front part 2, the back portion 3, and the front lower-berth portion 4 from a direction (9a, 9b, 9c, and 9d), passes the fan 5, and flows out in the direction of 19 from the

outlet 29. After cooling dehumidification of the air which passes 9b and 9c at this time was carried out by the front row side heat exchanger tube of front front part 2 heat exchanger, and the front row side heat exchanger tube of back partial 3 heat exchanger, Since it is heated by the back row side heat exchanger tube of front front part 2 heat exchanger, and the back row side heat exchanger tube of back partial 3 heat exchanger, Since the air by which cooling dehumidification was carried out, and the heated air are mixed very well, and there is no temperature fall as compared with suction air, it becomes the dehumidified air, there is moreover no temperature unevenness in air and it blows off, very comfortable indoor environment can be made. To front front part 2 heat exchanger and back partial 3 heat exchanger, in addition, in order to use front upper row slanting partial 1 heat exchanger as a reheater and to make front lower-berth partial 4 heat exchanger act as an evaporator, Quantity sufficient as heat exchanger capacity is secured, and air conditioning capacity sufficient also at the time of air conditioning reheat dehumidifying operation can be demonstrated.

[0047]The feature at the time of using R410A, R32, or R290 for this example as a refrigerant is explained. To R22 refrigerant conventionally used for the air conditioner, the ozone destruction coefficient ofRR410 290 [R32 / A] refrigerant is 0, the global warming potential of especially R32 and R290 is also smaller than R22 and R410A, and there is the feature of a refrigerant gentle to earth environment. In addition, R410A, R32, and R290 have the characteristic that a refrigerant pressure loss is small as compared with R22. As for R32, in a refrigerant pressure loss, as compared with R22, a refrigerant pressure loss will be 50% 70% R410A and R290 as compared with R22. Therefore, in R410A, R32, or R290, the temperature gradient of evaporator inlet temperature and outlet temperature becomes small, and has the characteristic that vaporizer temperature is equalized. Therefore, since the air which there is no temperature unevenness in the air by which came out of the evaporator and cooling dehumidification was carried out, it will mix with the heated air very well, and there is no temperature fall, and was dehumidified does not have temperature unevenness and blows off, It can be said that it is the refrigerant which agreed for the purpose of this example that very comfortable indoor environment can be made. moreover -- as a refrigerant -- a HFC system (R116, R125, R134a, R14, and R143a.) R152a, R227ea, R23, R236ea, R236fa, R245ca, R245fa, R32, R41, RC318, etc., Several sorts of mixed refrigerants R407A of these refrigerants, R407B, R407C, R407D, R407E, R410B, R404A, R507A, R508A, HC systems (butane, isobutane, ethane, and propane.), such as R508B propylene, etc. several sorts of mixed refrigerants of these refrigerants, and a natural refrigerant (air.) No matter what refrigerants [, such as several sorts of mixed refrigerants, such as carbon dioxide, ammonia, etc. several sorts of mixed refrigerants of these refrigerants and these HFC system, HC system, a natural refrigerant,] it may use, an ozone destruction coefficient is 0, and the effect is demonstrated.

[0048]The sectional view of the indoor unit of the air conditioner by another example of a 3rd embodiment is shown in drawing 11. The sign is the same as drawing 10, and the refrigerant circuit of this air conditioner is the same as that of drawing 2. There is a point of difference with drawing 10 in having put in the slitting 20 which intercepts these heat exchanger tubes thermally between the front row side heat exchanger tube of front front part 2 heat exchanger, and the back row side heat exchanger tube, and between the front row side heat exchanger tube of back partial 3 heat exchanger, and the back row side heat exchanger tube. An operation of this slitting to intercept is explained below.

[0049]in drawing 11, as well as Embodiment 3, the refrigerant flowed into indoor heat exchanger from the direction of 15, and it flowed into front upper row slanting partial 1 heat exchanger used as a reheater at the time of air conditioning reheat dehumidifying operation -- post branching being carried out and with the back row side heat exchanger tube of front front part 2 heat exchanger. It flows into the back row side heat exchanger tube of back partial 3 heat exchanger, and operates as a reheater. After this, a refrigerant joins, it flows into the 2nd flow control valve 10, is decompressed, it flows into the front row side heat exchanger tube of front front part 2 heat exchanger which acts as an evaporator, and the front row side heat exchanger tube of back partial 3 heat exchanger, and the refrigerant flows out of indoor heat exchanger from 16 after flowing into front lower-berth partial 4 heat exchanger. Heat conduction of the heat transfer fin

28 is carried out from the heat exchanger tube 11a with which a refrigerant with a high temperature flows at this time, the quantity of heat which gets across to the heat exchanger tube 11b with which a refrigerant with a low temperature flows exists, heat exchange is carried out between the heat exchanger tube 11a and 11b, and there is a possibility that the quantity of heat which carries out heat transfer to air may fall. For this reason, in this example, there is the feature which can reduce the quantity of heat which does not contribute to the air conditioning which carries out heat exchange with heat exchanger tubes by putting the slitting 20 which intercepts heat conduction into the heat transfer fin 28.

[0050]The sectional view of the indoor unit of the air conditioner by another example in a 3rd embodiment is shown in drawing 12. The sign is the same as drawing 11, and the refrigerant circuit of this air conditioner is the same as that of drawing 2. There is a point of difference with drawing 11 in having added the auxiliary heat exchanger 14 shown in a 2nd embodiment of this invention. Thereby, in addition to the effect in a 3rd embodiment of drawing 10 or drawing 11, the effect described by a 2nd embodiment of this invention can be doubled and demonstrated.

[0051]In drawing 10 of a 3rd embodiment, and 11 and 12, although the heat exchanger tube of indoor heat exchanger showed the example of two-row one, if it is considered as the refrigerant passage which has arranged the evaporator heat exchanger tube to the front row side, and has arranged the reheater heat exchanger tube to the back row side also in the case of multiple rows of two or more rows, the same effect will be acquired. Indoor heat exchanger is made into the structure in every row, and an effect with the same said of the heat exchanger made into multiple rows combining two or more one-row heat exchangers is acquired. Since each sequence is thermally intercepted at this time, the same effect as what was shown in drawing 11 is acquired. It is considered as the multi stage bending structure which has arranged indoor heat exchanger circularly or was further divided into a large number from drawing 10, and 11 and 12, For example, it intercepts between a reheater and evaporators thermally, even if it devises putting slitting into the heat transfer fin 28 of the interstage of the heat exchanger tube 11, and preventing heat conduction in a fin etc., the purpose of this invention is attained.

[0052]In the above, the heat exchanger capacity of the 2nd indoor heat exchanger 27 used as the heat exchanger capacity of the 1st indoor heat exchanger 25 used as the reheater by the embodiment of the 1st to 3 of this invention and an evaporator is described. An example with equal heat exchanger capacity of the 2nd indoor heat exchanger 27 that turns into heat exchanger capacity of the 1st indoor heat exchanger 25 used as a reheater, and an evaporator in drawing 1, Namely, although the example constituted from the front lower-berth portion 4, the front front part 2, the front upper row slanting portion 1, the back portion 3, and four steps of two-row plate finned tube heat exchangers was shown, The example from which the heat exchanger capacity of the 2nd indoor heat exchanger 27 used as the heat exchanger capacity of the 1st indoor heat exchanger 25 that turns into a reheater at drawing 9, and an evaporator differs, That is, the front lower-berth portion 4 shows the example which constitutes two-row four steps and the front upper row slanting portion 1 from five steps two-row and for which two-row three steps and the front front part 2 constitute the back portion 3 from a plate finned tube heat exchanger of two-row four-step **. In order to dehumidify preventing the fall of a room temperature, when indoor air conditions, for example, sensible heat load, are small, it is necessary to make heat exchanger capacity of the 1st indoor heat exchanger 25 used as a reheater more than the heat exchanger capacity of the 2nd indoor heat exchanger 27 used as an evaporator, and to secure heating capability almost equal to refrigeration capacity. However, if the heat exchanger capacity of the 2nd indoor heat exchanger 27 is too small, cooling dehumidification volume will become small, and the maximum latent heat capacity control range of the interior of a room at the time of air conditioning reheat dehumidifying operation becomes narrow. For this reason, in order to secure the wide range latent heat sensible heat heat-exchanging-capacity control range for dehumidifying preventing the fall of a room temperature. What is necessary is for the ratio of the heat exchanger capacity of the 1st suitable indoor heat exchanger 25 to the heat exchanger capacity of the 2nd indoor heat exchanger 27 to exist, and just to make into 60% - 65% heat exchanger capacity of the 1st indoor heat exchanger 25 that turns into a reheater to the whole indoor heat exchanger capacity. The wide range latent heat

sensible heat heat-exchanging-capacity control range which can be dehumidified without the temperature of the blow-off air 19 falling from 27 ** is securable at the time of the standard air conditioning air conditioning conditions as which it was determined by JIS, this time, for example, indoor environment, the indoor dry-bulb temperature of 27 **, and the indoor wet-bulb temperature of 19 **.

[0053]As mentioned above, although the heat exchanger tube shape of the heat exchanger of the 2nd indoor heat exchanger 27 used as the heat exchanger of the 1st indoor heat exchanger 25 used as the reheater by the embodiment of the 1st to 3 of this invention and an evaporator is 10 mm or less in outer diameter in a tube, The effect is attained even if it is a tube, an ellipse heat exchanger tube with an equivalent cross-section area, and a flat heat exchanger tube. for example with a reheater, many end liftings are provided in the heat transfer fin 28, heat transfer promotion with air is aimed at, it cuts with an evaporator, and the number of liftings is lessened, and open -- as who nature is raised, The heat transfer fin 28 may cut with the 2nd indoor heat exchanger 27 used as the heat exchanger of the 1st indoor heat exchanger 25 used as a reheater, and an evaporator, and lifting shape and a fin pitch may be changed. Also in each portion of a multi stage bending heat exchanger, the heat transfer fin 28 may cut and lifting shape and a fin pitch may be changed. The heat transfer fin 28 may cut with the 1st row heat exchanger and the 2nd row heat exchanger, and lifting shape and a fin pitch may be changed. In addition, a row number may be changed in each portion of a multi stage bending heat exchanger. For example, the back heat exchangers 3 may be constituted as an one-row heat exchanger, and cost reduction may be planned.

[0054]The refrigerant passage of the heat exchanger of the 2nd indoor heat exchanger 27 that turns into an evaporator in the embodiment of the 1st to 3 of the above this invention at the time of air conditioning reheat dehumidifying operation is explained. The refrigerant after coming out of the 2nd flow control valve 10 is distributed to drawing 1 by the branch pipe 30 two times, The example which flows into back partial 3 heat exchanger and front lower part 4 heat exchanger which comprised the heat exchanger tube 11 of the same number is shown, the refrigerant stream dynamic resistance in a pipe can become the same, and the unevenness of a refrigerant flow rate cannot arise, but uniform heat exchanging quantity can be secured, and the performance as an evaporator can fully be demonstrated. What is necessary is just to make it the branch pipe 30 become the same [the refrigerant stream dynamic resistance in a pipe] by more than dichotomy arranging a heat exchanger tube number etc. On the other hand, the refrigerant after coming out of the 2nd flow control valve 10 is distributed to drawing 6 by the branch pipe 30 two, and the example which flows into back partial 3 heat exchanger and front lower part 4 heat exchanger which comprised the heat exchanger tube 11 of a different number is shown in it. Since refrigerant passage length differs at this time, in the refrigerant stream dynamic resistance in a pipe of each channel, the unevenness of a difference refrigerant flow rate may arise strictly, but since there are not many refrigerant flow rates at the time of air conditioning reheat dehumidifying operation as a difference arises in the refrigerant stream dynamic resistance in a pipe of each channel, the unevenness of a refrigerant flow rate is not produced actually. Since refrigerant flow rate balance is determined by the heat load by the side of air when the suction air flow 9 has distribution, refrigerant passage length does not affect refrigerant flow rate balance. Since branch pipe 30 entrance after coming out of the 2nd flow control valve 10 serves as vapor-liquid two-phases flow, it tends to start a maldistribution with the branch pipe 30. Therefore, it becomes possible to be able to secure uniform heat exchanging quantity for the refrigerant flow direction in this branch pipe a perpendicular direction and by realizing uniform distribution of a gas-liquid two-phase refrigerant, and taking such measures by the device of making it desirable in the direction of a lift off, and to fully demonstrate the performance as an evaporator.

[0055]The air conditioner by a 4th embodiment of embodiment 4. this invention is explained. The structure of an indoor unit is drawing 1, and a refrigerant circuit is drawing 2 and uses R410A as a refrigerant. The flow control valve of the structure shown in drawing 13 was used for the 2nd flow control valve 10 arranged at the indoor unit 18 at this time. Hereafter, the structure of this flow control valve and operation are explained.

[0056]In drawing 13, 31 in the 2nd flow control valve 10 is connected to the 1st indoor heat exchanger 25 in the 1st channel, and 32 is connected to the 2nd indoor heat exchanger 27 in the 2nd channel.The main valve seat to which a refrigerant passage carries out the opening of 33, and 34 are the main valve bodies which slide up and down over the inner surface of 2nd flow-control-valve 10 main part, and constitute the converging section from these main valve seats 33 and the main valve body 34. 35 is a magnet coil which drives the main valve body 34, based on the instructions from a control section (with no graphic display), it carries out energization **** of the magnet coil 35, and the main valve body 34 is opened and closed. The main valve body 34 is formed of the porosity penetration material which is open for free passage to a refrigerant flow direction, specifically a metal powder, ceramic powder, firing metal, firing resin, etc. are put into a mold, and it carries out pressing, and comprises a thing burned and hardened at the temperature below a melting point. If it energizes to the magnet coil 35, the main valve body 34 will go up, it will separate from the main valve seat 33, and a refrigerant will flow that the 1st channel 31 and the 2nd channel 32 do not have flow resistance. If it energizes to the magnet coil 35 again, the main valve body 34 will descend, and will be stuck with the main valve seat 33, and the 1st channel 31 and the 2nd channel 32 will open it for free passage via the porosity penetration material which constitutes the main valve body 34.
[0057]Next, operation of the air conditioner using the flow control valve shown in this example is explained. Usually, a refrigerant usually flows in the direction shown in the arrow of the solid line of drawing 2 at the time of cooling operation in the direction shown in the arrow of the dotted line of drawing 2 at the time of heating operation. At this time, the flow of a refrigerating cycle is adjusted with the 1st flow control valve 24, as the 2nd flow control valve 10 is shown in drawing 13 (a), the main valve body 34 goes up, and separates from the main valve seat 33, the 1st channel 31 and the 2nd channel 32 open it for free passage, and a refrigerant flows without flow resistance. Therefore, there are no fall of capability and decline in efficiency by the increase in a refrigerant pressure loss, and an air conditioner can be operated.
[0058]On the other hand, as well as a 1st embodiment in this invention, the opening of the 1st flow control valve 24 is opened at the time of air conditioning reheat dehumidifying operation, it makes it feeling, and serves as a refrigerating cycle which uses the 2nd flow control valve 10 as a main pressure reducing device. The pressure-enthalpy diagram in the refrigerating cycle at the time of this air conditioning reheat dehumidifying operation as well as a 1st embodiment in this invention serves as drawing 3. That is, as the 2nd flow control valve 10 is shown in drawing 13 (b), the main valve body 34 descends, it sticks with the main valve seat 33, the 1st channel 31 and the 2nd channel 32 are open for free passage via the porosity penetration material which constitutes the main valve body 34, and porosity penetration material acts as a flow resistance object.
[0059]Since porosity penetration material is used as a flow resistance object of the 2nd flow control valve 10 at this time, the refrigerant flow sound at the time of a gas-liquid two-phase refrigerant or liquid cooling intermediation passing the 2nd flow control valve 10 can be reduced substantially. For example, since the 2nd conventional flow control valve 10 used for JP,10-89803,A shown in drawing 25 is making ORIIFISU of the crevice between the main valve seat 33 and the main valve body 34 act as a flow resistance object as shown in drawing 26, when vapor-liquid two-phases flow passes, a very loud refrigerant flow sound generates it. As shown especially in drawing 3, when the flow pattern of a gas-liquid two-phase refrigerant serves as slug flow small like D point in the entrance of the 2nd flow control valve 10 in refrigerant dryness, becoming a loud refrigerant flow sound is known. As a generation cause of this refrigerant flow sound, a vapor refrigerant flows intermittently to a flow direction, When bigger steamy slag than the diameter of ORIIFISU or steamy air bubbles pass an ORIIFISU part, In order that generate vibration when steamy slag or steamy air bubbles collapse, and may spread the main valve seat 33 grade in drawing 26, and a sound may occur or the vapor refrigerant which differs in speed, and liquid cooling intermediation may pass an ORIIFISU part by turns, It is for pressure fluctuation to arise in connection with it, to spread main valve seat 33 grade, and for a sound to occur.
[0060]On the other hand, in the 2nd flow control valve 10 in this example shown in drawing 13

(b), a gas-liquid two-phase refrigerant and liquid cooling intermediation pass the detailed and countless vent of the main valve body 34 which comprises porosity penetration material, and are decompressed. Therefore, neither steamy slag nor a steamy bubble collapses. In order that a vapor refrigerant and liquid cooling intermediation may pass a converging section simultaneously, it mixes very well and the velocity turbulence of a refrigerant does not arise, and a pressure is not changed, either. Although the number of channels is one in the 2nd conventional flow control valve 10 shown in drawing 26, an internal channel comprises porosity penetration material intricately, this stoma serves as a flow resistance object, and a pressure declines by this inside. Porosity penetration material has an effect which carries out pressure fluctuation to regularity, a flow velocity change being repeated as pressure fluctuation in the inside, and changing a part into heat energy. Generally this is called sound absorption effect and it is considered the mechanism which absorbs a sound. Since the rate of flow of a refrigerant is fully slowed down inside porosity penetration material and it becomes fixed, a jet noise also has an effect which becomes small, without an eddy occurring with a flow in a porosity penetration material exit part. For this reason, the refrigerant flow sound generated from the 2nd flow control valve 10 can be reduced substantially. Since an evaporator is arranged in the composition of Embodiments 1-3 mentioned above at the back portion 3 and the front lower-berth portion 4, The blow-off sound of the refrigerant which passed the converging section when the 2nd flow control valve like before was used spreads into the back portion 3 and the front lower-berth portion 4, As a result, noise is generated from both the front-face side suction opening (suction opening (9a, 9b, and 9d)) of the air conditioner indoor unit 18, and the upper surface side suction opening (a part of 9a and suction opening of 9c). Especially in the wall-type air conditioner generally used, the noise from the upper surface side suction opening is reflected in a ceiling surface right above, it is easy to get across to the interior of a room, and there are also worries about resonating with the noise from the front-face side suction opening further etc. Since blow-off noise can be reduced if the valve of porosity penetration material is used for the 2nd flow control valve like this embodiment, generating of the noise from the evaporator which makes the 2nd flow control valve a cause can be reduced.

[0061]Although this example showed the example which uses R410A as a refrigerant, Conventionally, since working pressure becomes high as compared with the refrigerant R22 (height of the points D and E shown in drawing 3), R410A needs to make flow resistance in the 2nd flow control valve 10 conventionally larger than the refrigerant R22, and needs to make the amount of decompression in the 2nd flow control valve 10 conventionally larger than the refrigerant R22. For this reason, in the 2nd conventional flow control valve 10 used for JP,10-89803,A shown, for example in drawing 25. It is necessary to make still smaller ORIIFISU of the crevice between the main valve seat 33 and the main valve body 34, and to enlarge flow resistance, and when R410A is used and vapor-liquid two-phases flow passes conventionally more nearly inevitably than the refrigerant R22, a very loud refrigerant flow sound will occur. Therefore, the effect of reducing a refrigerant flow sound substantially can be further demonstrated by applying the 2nd flow control valve 10 using the porosity penetration material shown in this example to an R410A refrigerant air rotary condenser. Even if it applies conventionally the 2nd flow control valve 10 using the porosity penetration material shown in this example to refrigerant R22 air conditioner, the effect is demonstrated enough. In addition, although working pressure is conventionally high as compared with the refrigerant R22, even if a global warming potential applies R22 and R32 refrigerant gentle to earth environment smaller than R410A to the air conditioner shown in this example, the effect is demonstrated enough. Even if a global warming potential applies R22 and R290 refrigerant gentle to earth environment extremely smaller than R410A to the air conditioner shown in this example, the effect is acquired enough. moreover -- as a refrigerant -- a HFC system (R116, R125, R134a, R14, and R143a.) R152a, R227ea, R23, R236ea, R236fa, R245ca, R245fa, R32, R41, RC318, etc., Several sorts of mixed refrigerants R407A of these refrigerants, R407B, R407C, R407D, R407E, R410B, R404A, R507A, R508A, HC systems (butane, isobutane, ethane, and propane.), such as R508B The effect is demonstrated no matter what refrigerants [, such as several sorts of mixed refrigerants, such as propylene, etc. several sorts of mixed refrigerants of these refrigerants, a natural refrigerant

(air, carbon dioxide, ammonia, etc. and several sorts of mixed refrigerants of these refrigerants) and these HCFC(s) system or a HFC system, HC system, and a natural refrigerant,] it may use.
[0062]The flow characteristics (relation between a refrigerant flow rate and a refrigerant pressure loss) of the 2nd flow control valve 10 at the time of air conditioning reheat dehumidifying operation, It can adjust by adjusting the voidage (clearance volume per unit volume) of the channel length which the size and refrigerant of the porosity penetration material used for the main valve body 34 pass, and porosity penetration material. Namely, what is necessary is to enlarge the aperture of porosity penetration material, to shorten channel length (for example, the element of porosity penetration material is enlarged), or just to use porosity penetration material with large (shortening a valve body) etc. and voidage, when passing a certain refrigerant flow rate by small pressure loss. What is necessary is to make the aperture of porosity penetration material small, when passing the refrigerant flow rate which exists conversely by big pressure loss, or to lengthen channel length (for example, the element of porosity penetration material is made small), or just to use porosity penetration material with small (lengthening a valve body) etc. and voidage. The aperture of porosity penetration material and the shape of a valve body of using for such a main valve body 34 are designed the optimal at the time of an air conditioner design.
[0063]Since a measure, such as twisting an insulator and a sound deadener around the circumference, is also unnecessary, and becomes the surroundings of the 2nd flow control valve 10 that was thereby conventionally required of the air conditioner with cost reduction and construction material besides these becomes still more unnecessary, the recycling efficiency of an air conditioner also improves.
[0064]Although the operation at the time of air conditioning reheat dehumidifying operation was described above, the same effect is acquired at the time of the heating dehumidifying operation which becomes reverse [a refrigerant flow direction] (refrigerating cycle operational status shown in drawing 4).
[0065]Even if it uses for the 1st flow control valve 24 the flow control valve using the porosity penetration material mentioned above, the same effect of reducing a refrigerant flow sound is acquired. Generating of the refrigerant flow sound resulting from the gas-liquid two-phase refrigerant mentioned above is received, It is a technical problem about the general refrigerating cycle of the cold energy air-conditioning equipment which includes a refrigerator etc. without being limited to an air conditioner, and the flow control valve shown in this embodiment is applying widely to such a general refrigerating cycle, and the same effect of reducing a refrigerant flow sound is acquired.
[0066]The air conditioner by a 5th embodiment of embodiment 5. this invention is explained. Drawing 15 is a refrigerant circuit of this invention, and has attached the same number to the same part as drawing 2. The structure of the indoor unit 18 is drawing 1, and uses R410A as a refrigerant. The collimator 36 which used porosity penetration material for piping between the 1st indoor heat exchanger 25 and the 2nd indoor heat exchanger 27 which are arranged at the indoor unit 18 at this time was formed, and the electromagnetism opening and closing valve 37 is formed on the refrigerant passage which bypasses the collimator 36 to this and parallel. An example of the structure of this collimator 36 is shown in drawing 14. Collimator 36 main part comprises a cylindrical container, and is made into the structure where the sintered metal 38 which is an example of porosity penetration material puts ORIIFISU 39. As stated also to Embodiment 4 as other examples of porosity penetration material, what is necessary is just the thing which put a metal powder, ceramic powder, firing metal, firing resin, etc. into the mold, carried out pressing, and was burned and hardened at the temperature below a melting point. And the both ends of the sintered metal 38 are being fixed by the spring 40 and the projection 41. Hereafter, operation of this collimator 36 and the electromagnetism opening and closing valve 37 is explained.
[0067]In this embodiment, the electromagnetism opening and closing valve 37 is usually made the time of cooling operation with an opened state at the time of heating operation, and a refrigerant passage is usually constituted. Since the flow resistance of the electromagnetism opening and closing valve 37 is small, a refrigerant bypasses the collimator 36 and flows [as opposed to / at

this time / the flow resistance of the collimator 36] through the electromagnetism opening and closing valve 37. Therefore, there are no fall of capability and decline in efficiency by the increase in a refrigerant pressure loss, and an air conditioner can be operated. On the other hand, the refrigerating cycle operational status at the time of air conditioning reheat dehumidifying operation is the same as that of drawing 3, the electromagnetism opening and closing valve 37 is made into a closed state, and a refrigerant is decompressed through the collimator 36. At this time, the gas-liquid two-phase refrigerant which flowed into the arrow direction of the solid line in drawing 14 passes the sintered metal 38. At this time, the sintered metal 38 can show the same operation as the porosity penetration material used for the main valve body 34 of drawing 13 (b) in Embodiment 4, and can prevent generating of a refrigerant flow sound.
[0068]Although it was considered as the structure where the sintered metal 38 puts ORIIFISU 39, in drawing 14, ORIIFISU 39 is a thing for flow resistance to be small, and for a predetermined decompression action to be obtained only by the sintered metal 38, and use together to a case, As long as it can adjust flow resistance by adjusting the voidage (clearance volume per unit volume) of the channel length which the size and refrigerant of porosity penetration material pass, and porosity penetration material, it may use as flow resistance by sintered metal 38 independent one. When using ORIIFISU 39 together, since the vapor-liquid two-phases flow which passes also as arrangement of only the refrigerant flow upstream 38a of ORIIFISU 39 or the refrigerant flow downstream 38b is mixed very well, the sintered metal 38 can prevent generating of a refrigerant flow sound. At the time of heating dehumidifying operation, although a refrigerant flows into the arrow direction of the dotted line in drawing 14, the refrigerant flow sound reduction effect same also at this time as the time of air conditioning reheat dehumidification can be acquired. The collimator 36 is made into an easy structure where the sintered metal 38 puts ORIIFISU 39, Since the electromagnetism opening and closing valve 37 can divert the two-way valve used from the former [be / very cheaper than the flow control valve using the porosity penetration material used for the main valve body 34 like drawing 13 in Embodiment 4], Even if it uses together the collimator 36 and the electromagnetism opening and closing valve 37, it can be made cheaper than the flow control valve 10 of drawing 13 in Embodiment 4.
[0069]The effect described above demonstrates especially the effect, when an R410A refrigerant is used, but. the conventional refrigerant R22 and a HFC system (R116, R125, R134a, R14, and R143a.) R152a, R227ea, R23, R236ea, R236fa, R245ca, R245fa, R32, R41, RC318, etc., Several sorts of mixed refrigerants R407A of these refrigerants, R407B, R407C, R407D, R407E, R410B, R404A, R507A, R508A, HC systems (butane, isobutane, ethane, and propane.), such as R508B The effect is demonstrated no matter what refrigerants [, such as several sorts of mixed refrigerants, such as propylene, etc. several sorts of mixed refrigerants of these refrigerants, a natural refrigerant (air, carbon dioxide, ammonia, etc. and several sorts of mixed refrigerants of these refrigerants) and these HCFC(s) system or a HFC system, HC system, and a natural refrigerant,] it may use.
[0070]Other constructional examples of the collimator 36 in a 5th embodiment of this invention are shown in drawing 16 and drawing 17. An internal end is closed, and the sintered metal 38 in drawing 16 forms the cylindrical shape in which many items were opened wide, and is being fixed by ORIIFISU 39, the spring 40, and the projection 41. A circumference section cuts ORIIFISU 39 selectively and it serves as ****** discoid, It is the structure which a part oozes out from the circumference of a cylindrical outer surface, and a part oozes out from the bottom of a cylindrical outer surface, and the refrigerant which flowed from the direction of an arrow flows into sintered metal 38 cylindrical inside, is decompressed, and is decompressed [flows out of the center of ORIIFISU 39 and] from notching of the circumference section of ORIIFISU 39.
[0071]On the other hand, the sintered metal 38 of the shape as drawing 16 with same drawing 17 is being fixed by ORIIFISU 39, the spring 40, and the projection 41. It is the structure which in a part a part flows from the center of ORIIFISU 39, and the refrigerant which flowed from the direction of an arrow is decompressed from notching of the circumference section of ORIIFISU 39, and is flowed and decompressed from the circumference of the cylindrical bottom of the

sintered metal 38, or a cylindrical outer surface. In the case of which [of drawing 16 and drawing 17], with the collimator 36, a refrigerant flow sound can be substantially reduced by constituting the converging section from the sintered metal 38.

[0072]In Embodiments 4 and 5, although porosity penetration material explained the example of a disk or cylindrical shape, when a rectangular parallelepiped etc. may be constituted from what kind of shape and a refrigerant passes porosity penetration material, without restricting to this, a predetermined decompression action should just be obtained.

[0073]The air conditioner by a 6th embodiment of embodiment 6. this invention is explained. Drawing 18 is a refrigerant circuit of this invention, the refrigerant uses R410A and the same number is attached to the same part as drawing 2. The structure of an indoor unit is drawing 1. The outdoor heat exchanger 23 arranged at an outdoor unit at this time and the refrigerant circuit 51 which bypasses the 1st flow control valve 24 were formed, and the flow control valve 52 is formed on this refrigerant circuit. Hereafter, this operation of the refrigerant circuit 51 and the flow control valve 52 to bypass is explained.

[0074]In this embodiment, the flow control valve 52 is usually made the time of cooling operation with a closed state at the time of heating operation, and the usual refrigerant passage is usually constituted. At the time of air conditioning reheat dehumidifying operation, when the flow control valve 52 is made into a closed state, refrigerating cycle operational status is the same as that of drawing 3. On the other hand, refrigerating cycle operational status when the flow control valve 52 is made into an opened state at the time of air conditioning reheat dehumidifying operation is shown in drawing 19. Since a refrigerant flows through the refrigerant circuit 51 which does not almost have flow resistance without flowing through the outdoor heat exchanger 23 at this time, it flows into the 1st indoor heat exchanger 25 (C point) that turns into a reheater by an overheating gaseous state, without condensing by the outdoor heat exchanger 23, and all the heat of condensation heats indoor air. Then, it flows into the 2nd flow control valve (D point), is decompressed (E point), and evaporates in the 2nd indoor heat exchanger 27, and cooling dehumidification of the indoor air is carried out. Therefore, the capacity control range of the reheat dehumidifying operation which dehumidifies while being able to obtain more reheat heat exchanging quantity and preventing the fall of a room temperature from the time of making the flow control valve 52 into a closed state is expandable. Since a refrigerant flows through the refrigerant circuit 51 by making the flow control valve 52 into an opened state also at the time of heating reheat operation dehumidification, Rather than the time of evaporating altogether in the 1st indoor heat exchanger 25, and making the flow control valve 52 into a closed state, without a refrigerant evaporating in the outdoor heat exchanger 23, since more evaporation heat exchange quantity can be obtained, dehumidification volume can be made to increase and the capacity control range of reheat dehumidifying operation can be expanded. Conventionally, even if mixing with the air which passed the evaporator, and the air which passed the reheater raised reheat dehumidification capacity in vain well [so] in the thing of drawing 25, by it, had become a cause of Russian generating, but. If it is considered as the good thing of the mixed state of air as shown in Embodiments 1-3, it will become possible to aim at increase of such sensible heat capability, and to raise reheat dehumidification capacity. The effect described above only not only in when an R410A refrigerant is used, the conventional refrigerant R22 and a HFC system (R116, R125, R134a, R14, and R143a.) R152a, R227ea, R23, R236ea, R236fa, R245ca, R245fa, R32, R41, RC318, etc., Several sorts of mixed refrigerants R407A of these refrigerants, R407B, R407C, R407D, R407E, R410B, R404A, R507A, R508A, HC systems (butane, isobutane, ethane, and propane.), such as R508B The effect is demonstrated no matter what refrigerants [, such as several sorts of mixed refrigerants, such as propylene, etc. several sorts of mixed refrigerants of these refrigerants, a natural refrigerant (air, carbon dioxide, ammonia, etc. and several sorts of mixed refrigerants of these refrigerants) and these HCFC(s) system or a HFC system, HC system, and a natural refrigerant,] it may use.

[0075]The air conditioner by a 7th embodiment of embodiment 7. this invention is explained. Drawing 20 is a refrigerant circuit of this invention, the refrigerant uses R410A and the same number is attached to the same part as drawing 2. The structure of the indoor unit 18 is drawing 1. The heat exchanger 53 which carries out heat exchange of the 1st indoor heat exchanger 25,

piping between the 2nd flow control valve 10, and the 2nd indoor heat exchanger 27 and piping between the four-way valves 22 at this time was formed, and the electromagnetism opening and closing valve 54 is formed in the refrigerant circuit which bypasses the 2nd flow control valve 10. Hereafter, operation of this heat exchanger 53 and the electromagnetism opening and closing valve 54 is explained.

[0076]In this embodiment, the flow control valve 54 is usually made the time of cooling operation with an opened state at the time of heating operation, and the usual refrigerant passage is usually constituted. After making the flow control valve 54 into a closed state at the time of air conditioning reheat dehumidifying operation, the opening of the 1st flow control valve 24 is opened, and it is considered as feeling, and becomes a refrigerating cycle which uses the 2nd flow control valve 10 as a main pressure reducing device. The pressure-enthalpy diagram in the refrigerating cycle at the time of this air conditioning reheat dehumidifying operation is shown in drawing 21. A-H in drawing 21 corresponds to A-H in the refrigerant circuit in drawing 20, respectively, and shows the refrigerant flow direction at the time of air conditioning reheat dehumidifying operation by the arrow of the solid line in drawing 20. The refrigerant which was breathed out from the compressor 21 and passed along the four-way valve 22 is condensed by the outdoor heat exchanger 23 from an A point, serves as a B point, is decompressed a little by the 1st flow control valve 24, serves as C point, and flows into the 1st indoor heat exchanger 25. At this time, the 1st indoor heat exchanger 25 acts as a reheater, and is re-condensed to D point. By the low temperature low pressure refrigerant and the heat exchanger 53 which flow through the outlet piping of the 2nd indoor heat exchanger 27, heat exchange is carried out, it is cooled, and the refrigerant which came out of D point after this serves as supercooling liquid, and serves as E point. It is decompressed to F point through the 2nd flow control valve 10 after this, and flows into the 2nd indoor heat exchanger 27. At this time, the 2nd indoor heat exchanger 27 acts as an evaporator, evaporates to G point, by the high-temperature-high-pressure refrigerant and the heat exchanger 53 which flow through the outlet piping of the 1st indoor heat exchanger 25, heat exchange of it is carried out, is heated, serves as H point, and serves as a refrigerating cycle which returns to inhalation of the compressor 21.

[0077]Therefore, since a 2nd flow-control-valve 10 entrance refrigerant will be in a liquid condition as shown in drawing 21, as compared with the device with which the refrigerant of a gas-liquid two phase state flows into the 2nd flow control valve 10, the refrigerant flow sound at the time of a refrigerant passing can be reduced substantially. In the composition of Embodiments 1-3 mentioned above. Since an evaporator is arranged at the back portion 3 and the front lower-berth portion 4, the blow-off sound of the refrigerant which passed the converging section when the 2nd flow control valve like before was used spreads into the back portion 3 and the front lower-berth portion 4, As a result, noise is generated from both the front-face side suction opening (suction opening (9a, 9b, and 9d)) of the air conditioner indoor unit 18, and the upper surface side suction opening (a part of 9a and suction opening of 9c). Especially in the wall-type air conditioner generally used, the noise from the upper surface side suction opening is reflected in a ceiling surface right above, it is easy to get across to the interior of a room, and there are also worries about resonating with the noise from the front-face side suction opening further etc. Since the blow-off noise from the 2nd flow control valve can be reduced if the heat exchanger 53 is formed like this embodiment and the entrance refrigerant of the 2nd flow control valve is made into a liquid condition, generating of the noise from the evaporator which makes the 2nd flow control valve a cause can be reduced. In this embodiment, although the example which contacts piping of D point to E point for piping of G point to H point, and carries out heat exchange was shown, even if it constitutes the indoor unit 18, without restricting to this so that piping of D point to E point may be cooled with indoor blow-off air, the same effect is acquired.

[0078]although any refrigerants are demonstrated, since the efficiency of the effect described above whose one where a supercooling degree is larger is a refrigerating cycle improves more whenRR410 290 [R32 / A] refrigerant especially with large liquor-to-wood-ratio heat is used, it can demonstrate the effect further. moreover -- as a refrigerant -- a HCFC system (R22, R123, etc. and several sorts of mixed refrigerants of these refrigerants), and a HFC system (R116,

R125, and R134a.) R14, R143a, R152a, R227ea, R23, R236ea, R236fa, R245ca, R245fa, R32, R41, RC318, etc., Several sorts of mixed refrigerants R407A of these refrigerants, R407B, R407C, R407D, R407E, R410B, R404A, R507A, R508A, HC systems (butane, isobutane, ethane, and propane.), such as R508B The effect is demonstrated even if it uses several sorts of mixed refrigerants, such as propylene, etc. several sorts of mixed refrigerants of these refrigerants, a natural refrigerant (air, carbon dioxide, ammonia, etc. and several sorts of mixed refrigerants of these refrigerants) and these HCFC(s) system and a HFC system, HC system, and a natural refrigerant, etc.

[0079]The air conditioner by an 8th embodiment of embodiment 8. this invention is explained. Drawing 22 is a refrigerant circuit of this invention, the refrigerant uses R410A and the same number is attached to the same part as drawing 2. The structure of the indoor unit 18 is drawing 1. At this time, the container 55 which stores liquid cooling intermediation like a high voltage receiver, for example is formed in piping between the 1st indoor heat exchanger 25 and the 1st flow control valve 24. Hereafter, operation of this container 55 is explained.

[0080]In this embodiment, the surplus refrigerant by which it is usually generated at the time of heating operation and heating dehumidifying operation is stored in this container 55, and it serves to prevent the degradation by the excess of a refrigerant at the time of these operations in it. That is, at the time of air conditioning reheat dehumidifying operation, the outdoor heat exchanger 23 and the 1st indoor heat exchanger 25 operate as a condenser, and since the content volume of heat exchange becomes large, a needed refrigerant amount increases. Therefore, the restoration refrigerant amount of this air conditioner turns into a refrigerant amount for making it not become insufficient [a refrigerant] at the time of air conditioning reheat dehumidifying operation. On the other hand, there is little content volume of the heat exchange which serves as a condenser since the 2nd indoor heat exchanger 27 and the 1st indoor heat exchanger 25 turn into a condenser and only the 2nd indoor heat exchanger 27 turns into a condenser at the time of heating dehumidifying operation as compared with the time of a refrigerant at the time of heating operation, and the required refrigerant amount at the time of these operations usually becomes less than the time of air conditioning. Therefore, if heating operation or heating dehumidifying operation is performed without forming the container 55 in the refrigerant fill ration of an air conditioning reheat dehumidifying operation standard, it will become operation of the excess of a refrigerant and problems, such as decline in efficiency and a fall of the reliability by the amount increase of liquid backs to the compressor 21, will arise.

[0081]Therefore, by storing the surplus refrigerant by which it is usually generated by forming the container 55 in this embodiment at the time of heating operation and heating dehumidifying operation, and controlling the amount of circulating refrigerants in all the modes of operation the optimal, The improvement in compressor 21 reliability at the time of these operations and improve efficiency can be attained. The content volume of the container 55 calculates the optimal refrigerant amount in each mode of operation by an examination or calculation beforehand, and should just determine it as content volume which can store the difference of the maximum refrigerant amount and minimum refrigerant amount. Although the example which installs this container 55 in the outdoor unit 17 was shown in drawing 22, that effect is demonstrated even if it provides in the indoor unit 18. the effect described above -- as a refrigerant -- the conventional refrigerant R22 and a HFC system (R116, R125, and R134a.) R14, R143a, R152a, R227ea, R23, R236ea, R236fa, R245ca, R245fa, R32, R41, RC318, etc., Several sorts of mixed refrigerants R407A of these refrigerants, R407B, R407C, R407D, R407E, R410B, R404A, R507A, R508A, HC systems (butane, isobutane, ethane, and propane.), such as R508B Any refrigerants, such as several sorts of mixed refrigerants, such as propylene, etc. several sorts of mixed refrigerants of these refrigerants, a natural refrigerant (air, carbon dioxide, ammonia, etc. and several sorts of mixed refrigerants of these refrigerants) and these HCFC(s) system and a HFC system, HC system, and a natural refrigerant, can demonstrate the effect.

[0082]The air conditioner by a 9th embodiment of embodiment 9. this invention is explained. Drawing 23 is a lineblock diagram of the various sensor actuator control apparatus used for the refrigerant circuit and operation control of this invention, the refrigerant uses R410A and the same number is attached to the same part as drawing 2. The structure of the indoor unit 18 is

drawing 1. Hereafter, the operation control method of the air conditioner in this embodiment is explained. The air conditioner is equipped with the setting device 75 for an indoor resident to set up favorite temperature-and-humidity environment. In this setting device 75, although both temperature and humidity are set up, for example, a resident may do the direct entry of this setting-out temperature and humidity from the remote control which is attached to the indoor unit 18 in each preset value. In order to detect an indoor temperature and humidity, the suction air temperature sensor 65 and the humidity sensor 66 of the indoor unit 18 are formed in the indoor unit 18, respectively.

[0083]At the time of air conditioner operation, the difference of setting-out temperature and humidity and the present indoor sink air temperature and humidity is calculated as a temperature-and-humidity deviation, and the latent heat and sensible heat load which are indoor air conditioning load are guessed with the 1st arithmetic unit 67 from these deviations. Through the signal wire 73 so that these deviations may become in zero or less than a predetermined value And each actuator of an air conditioner, A control signal is transmitted to compressor 21 number of rotations, outdoor fan 61 number of rotations, indoor fan 63 number of rotations, the drawing opening of the 1st flow control valve 24, and the drawing opening of the 2nd flow control valve 10, by controlling these actuators, latent heat and sensible heat capability are adjusted, and air conditioning capacity is demonstrated. Usually, although the control method of the time of cooling operation or these actuators at the time of heating operation usually is the same as that of the conventional air conditioner which does not operate the 2nd flow control valve 10 as full admission, The refrigerating cycle at the time of air conditioning reheat dehumidifying operation adjusts the capability of the 2nd indoor heat exchanger used as the 1st indoor heat exchanger capability to become being the same as that of the pressure-enthalpy diagram shown in drawing 3, and to become a reheater, and an evaporator, controls latent heat and sensible heat load, and demonstrates air conditioning capacity. The change in latent heat capability adjusts by the change in the capability of the 2nd indoor heat exchanger used as an evaporator. On the other hand, since sensible heat capability also increases by the increase in evaporator capability, when the sensible heat capability more than sensible heat load is demonstrated, it adjusts to the direction to which the capability of the 1st indoor heat exchanger used as a reheater is made to increase, and heats, and sensible heat capability is adjusted. The control method of each actuator at this time is explained below.

[0084]For example, as the 1st example, the information on the indoor latent heat sensible heat load guessed with the 1st arithmetic unit 67 from the temperature-and-humidity deviation at the time of air conditioner operation goes via the signal wire 73a in the indoor unit 18, It is transmitted to the 2nd arithmetic unit 74, and the number-of-rotations variation of the indoor fan motor 64 of the indoor fan 63 calculates. Namely, the information on the indoor fan 63 present number of rotations is transmitted to the 2nd arithmetic unit 74 via the signal wire 73a from the indoor fan motor 64 revolving-speed-control device 69, Indoor fan motor 64 number of rotations is calculated as a larger value than the actual condition, and the information on indoor fan motor 64 new number of rotations is transmitted to the indoor fan motor revolving-speed-control device 69 via the signal wire 73a, and is controlled as indoor fan motor 64 new number of rotations, so that indoor latent heat sensible heat load is large. In this way, latent heat sensible heat capability increases by the increase in blast weight of the indoor fan 63.

[0085]For example, the information on the indoor latent heat sensible heat load guessed with the 1st arithmetic unit 67 from the temperature-and-humidity deviation at the time of air conditioner operation is transmitted to the 2nd arithmetic unit 74 via the signal wire 73a as the 2nd example, and the number-of-rotations variation of the outdoor fan motor 62 of the outdoor fan 61 calculates. The information on the outdoor fan 62 present number of rotations from the outdoor fan motor 62 revolving-speed-control device 68 Namely, the signal wire 73c in the outdoor unit 17, And it is transmitted to the 2nd arithmetic unit 74 via the signal wire 73b which ties the outdoor unit 17 and the indoor unit 18, Outdoor fan motor 62 number of rotations is calculated as a value smaller than the actual condition as the time of liking to enlarge reheat heat exchanging quantity in the interior of a room, The information on outdoor fan motor 62 new number of rotations is transmitted to the outdoor fan motor revolving-speed-control device 68

via the signal wires 73b and 73c, and is controlled as outdoor fan motor 62 new number of rotations. At this time, outdoor condensing capacity declines due to the blast weight fall of the outdoor fan 61, the condensing capacity in the 1st indoor heat exchanger 25 increases relatively, the reheat heat exchanging quantity in the interior of a room increases, and sensible heat heat exchanging quantity can be controlled.

[0086]For example, the information on the indoor latent heat sensible heat load guessed with the 1st arithmetic unit 67 from the temperature-and-humidity deviation at the time of air conditioner operation is transmitted to the 2nd arithmetic unit 74 via the signal wire 73a as the 3rd example, and the variation of compressor 21 number of rotations calculates. The information on the compressor 21 present number of rotations from the compressor revolving-speed-control device 70 Namely, the signal wire 73c, The time of being transmitted to the 2nd arithmetic unit 74 via 73b, and liking to enlarge indoor latent heat sensible heat heat exchanging quantity, Compressor 21 number of rotations is calculated as a larger value than the actual condition, and the information on compressor 21 new number of rotations is transmitted to the compressor revolving-speed-control device 70 via the signal wires 73b and 73c, and is controlled as compressor 21 new number of rotations. In the refrigerating cycle in the pressure-enthalpy diagram shown in drawing 3 at this time, the latent heat sensible heat heat exchanging quantity in the interior of a room increases by the increase in a refrigerant flow rate.

[0087]For example, the information on the indoor latent heat sensible heat load guessed with the 1st arithmetic unit 67 from the temperature-and-humidity deviation at the time of air conditioner operation is transmitted to the 2nd arithmetic unit 74 via the signal wire 73a as the 4th example, and the valve opening variation of the 1st flow control valve 24 calculates. The valve opening information on the 1st present flow control valve 24 from the 1st flow-control-valve 24 valve-opening control device 71 Namely, the signal wire 73c, The time of being transmitted to the 2nd arithmetic unit 74 via 73b, and liking to enlarge sensible heat heat exchanging quantity in the interior of a room, The valve opening of the 1st flow control valve 24 is calculated as a value smaller than the actual condition, and the information on the valve opening of the 1st new flow control valve 24 is transmitted to the valve opening control device 71 of the 1st flow control valve 24 via the signal wires 73b and 73c, and is controlled as a valve opening of the 1st new flow control valve 24. At this time, the pressure between the point C shown in drawing 3 and the point D declines, the condensation temperature in the 1st indoor heat exchanger 25 falls, reheat heat exchanging quantity falls, and the sensible heat heat exchanging quantity in the interior of a room is adjusted with the fall of the valve opening of the 1st flow control valve 24.

[0088]For example, the information on the indoor latent heat sensible heat load guessed with the 1st arithmetic unit 67 from the temperature-and-humidity deviation at the time of air conditioner operation is transmitted to the 2nd arithmetic unit 74 via the signal wire 73a as the 5th example, and the valve opening variation of the 2nd flow control valve 10 calculates. Namely, the valve opening information on the 2nd present flow control valve 10 is transmitted to the 2nd arithmetic unit 74 via the signal wire 73a from the 2nd flow-control-valve 10 valve-opening control device 72, The valve opening of the 2nd flow control valve 10 is calculated as a value smaller than the actual condition as the time of liking to enlarge latent heat sensible heat heat exchanging quantity in the interior of a room, The information on the valve opening of the 2nd new flow control valve 10 is transmitted to the 2nd flow-control-valve 10 valve-opening control device 72 via the signal wire 73a, and is controlled as a valve opening of the 2nd new flow control valve 10. At this time, the pressure between the point E shown in drawing 3 and the point F declines, the evaporating temperature in the 2nd indoor heat exchanger 27 falls, and the latent heat sensible heat heat exchanging quantity in the interior of a room is adjusted with the fall of the valve opening of the 2nd flow control valve 10.

[0089]although five kinds of control methods of each actuator were described as the 5th example from the above-mentioned 1st, These actuators may be individually controlled based on a variety of information, may be controlled combining the specific actuator in five kinds, may control another actuator based on the specific actuator information in five kinds, or may give and control a priority to each actuator. For example, when the number of rotations of the compressor 21 is made to increase in the state where indoor fan 63 blast weight is small,

although latent heat sensible heat heat exchanging quantity increases, evaporating temperature will fall too much, it will be 0 ** or less, and there is a possibility of drain water being frozen and damaging the indoor unit 18. At this time, provide a lower limit in indoor fan 63 blast weight, and when it is below a value with indoor fan motor 64 number of rotations equivalent to this blast weight, upper limit is provided in compressor 21 number of rotations, Raise indoor fan motor 64 number of rotations, indoor fan 63 blast weight is made to increase, and what is necessary is just to control so that evaporating temperature will be 0 ** or more when latent heat sensible heat heat exchanging quantity required in the range of this value is not obtained. For example, when controlling latent heat sensible heat heat exchanging quantity only by the control devices 69 and 72, It becomes unnecessary to transmit information between the indoor unit 18 and the outdoor unit 17, and the signal wire 73b between the indoor unit 18 and the outdoor unit 17 becomes unnecessary, and can prevent the malfunction by an open circuit and poor connection of the signal wire 73b. Although drawing 21 showed the example which installs the 2nd arithmetic unit 74 in the indoor unit 18, it may install in the outdoor unit 17. When controlling only by the control device 68, and 70 and 72 at this time, for example, latent heat sensible heat heat exchanging quantity, The number of rotations of the information on the indoor latent heat sensible heat load guessed with the 1st arithmetic unit 67, and the actual condition of the indoor fan 63, And the information on the valve opening of the 2nd flow control valve 10 is transmitted to the 2nd arithmetic unit 74 via the signal wires 73a and 73b, a control signal is transmitted through 73c, and the control device 68, and 70 and 72 operate. Namely, since there is no return of the control signal from the outdoor unit 17 to the indoor unit 18, no matter the actuator in the indoor unit 18 may be in what operation situation, indoor latent heat sensible heat capability can be adjusted (even if a resident chooses the blast weight of the indoor fan 63 freely).

[0090]What is necessary is just to continue the present operation, when a temperature-and-humidity deviation becomes by the control method described above in zero or less than a predetermined value. Thus, by controlling various actuators by this embodiment according to the latent heat sensible heat load at the time of air conditioning reheat dehumidifying operation, Since the temperature-and-humidity environment in the room can be controlled in the optimal state according to a resident's liking and structure of the indoor unit 18 is moreover carried out like drawing 1, it will be in the state where blow-off air does not have temperature unevenness, either, and comfortable indoor environment can be acquired. If it doubles and porosity penetration material is used for the 2nd flow control valve 10, a refrigerant flow sound will decrease and more comfortable indoor environment will be attained. If various actuators are controlled by the same method as the time of the air conditioning reheat dehumidification which mentioned above also at the time of heating dehumidifying operation, comfortable indoor environment can be acquired.

[0091]The air conditioner by a 10th embodiment of embodiment 10. this invention is explained. A refrigerant circuit figure is the same as that of drawing 2, and the composition of the indoor unit 18 is the same as that of drawing 1. As a refrigerant, R290 or R32 which is an inflammability is used. And while equipping the 1st flow control valve 24, the 2nd flow control valve 10, or the flow control valve of the both with a full-close function, It had a means (not shown) to detect a refrigerant leak, and when a refrigerant leak was detected during air conditioner operation and a stop, it had the means (not shown) which carries out full close of these flow control valves. By this closing a refrigerant in a refrigerant circuit, the refrigerant leak to the interior of a room can be prevented, and the safety in the air conditioner using an inflammable refrigerant can be secured.

[0092]In the air conditioner stated to Embodiments 1-10 above, As refrigerating machine oil, to refrigerants mentioned above, such as HCFC, HFC and HC refrigerants, and a natural refrigerant, even if it is immiscible nature, poorly soluble refrigerating machine oil, or refrigerating machine oil of compatibility, An alkylbenzene system, a mineral oil system, an ester-oil system, an ether oil system, a fluoride oil system, etc. can attain the effect about any refrigerating machine oil.

[0093]In the air conditioner stated to Embodiments 1-10 above, although the outdoor unit 17 and the indoor unit 18 showed the example of the air conditioner which is one set at a time, as for the effect, the outdoor unit 17 is attained also in the air conditioner machine which is [two or

more] in one set as for the number of the indoor units 18. As refrigerating machine oil, to refrigerants mentioned above, such as HCFC, HFC and HC refrigerants, and a natural refrigerant, even if it is immiscible nature, poorly soluble refrigerating machine oil, or refrigerating machine oil of compatibility, An alkylbenzene system, a mineral oil system, an ester-oil system, an ether oil system, a fluoride oil system, etc. can attain the effect about any refrigerating machine oil.
[0094]In the air conditioner arranged so that it may have a compressor, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger, indoor heat exchanger may be applied to the back from the front face of an interior unit and a fan may be surrounded, since this invention is constituted as explained above, While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, While this reheater and evaporator are thermally intercepted in a reheater and the refrigerant flow downstream in the mode of operation operated as an evaporator, the refrigerant flow upstream of this 2nd flow control valve, Since the refrigerant passage that the transverse plane of said indoor heat exchanger or a front upper row slanting part was made to act as a reheater, and said indoor heat exchanger front lower part and said indoor heat exchanger back lower part acted as an evaporator was constituted, Since the heated air and the air by which cooling dehumidification was carried out are efficiently mixed by a fan, since the air blowing off turns into air which there is no temperature fall and was dehumidified as compared with suction air, and there is moreover no temperature unevenness in air and it blows off, it can make comfortable indoor environment. The problem on reliability that dew will blow off from an outlet with blow-off air is cancelable. Since the dew which was transmitted to it and dehumidified the heat exchanger by installing a drain pan in each heat exchanger lower part used as an evaporator is directly recoverable, reliability is securable.
[0095]Since refrigerant inflow piping to the above-mentioned reheater installed in the upstream of the suction air flow to indoor heat exchanger and refrigerant inflow piping to the above-mentioned evaporator installed in the upstream of the suction air flow to indoor heat exchanger, The heated air and the air by which cooling dehumidification was carried out are mixed further more efficiently, there is no temperature unevenness, and since it blows off, comfortable indoor environment can be made.
[0096]While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, Since it had the auxiliary heat exchanger thermally intercepted [downstream / a reheater and / refrigerant flow] by the refrigerant flow upstream of the reheater in the refrigerant flow upstream of this 2nd flow control valve at the time of the mode of operation operated as an evaporator, Reheat heat exchanger capacity is expanded and reheat heat exchanging quantity increases, and it becomes possible to enlarge the capacity control range which carries out reheat dehumidification, preventing a room temperature fall. The opening space in an indoor unit can be utilized effectively, and miniaturization of an indoor unit is also attained. The indoor heat exchanger capability at the time of heating operation can usually be raised.
[0097]Since said auxiliary heat exchanger was installed in the air flow windward of said reheater, it can counter with air with a low temperature, a refrigerant can flow, and heat exchanging performance can be raised more.
[0098]Since the draft resistance of said auxiliary heat exchanger was made smaller than other heat exchangers, heat exchanging performance can be raised suppressing increase of the pressure loss by the side of ventilation.
[0099]Since R410A, or R32 or R290 was used as a refrigerant, it can be useful for the prevention from ozone layer depletion, or global warming.
[0100]Since the refrigerant passage of the auxiliary heat exchanger was made into one line, using R410A, or R32 or R290 as a refrigerant, it can be useful for the prevention from ozone layer depletion, or global warming, and the indoor heat exchanger capability at the time of heating operation can usually be raised more.
[0101]In the air conditioner provided with a compressor, a four-way valve, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger using R410A, or R32 or R290 as a refrigerant, While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, Since the air flow upstream constituted the refrigerant passage that an evaporator and an air flow downstream side acted as a reheater in the dehumidifying

operation mode in which the refrigerant flow upstream of this 2nd flow control valve operates a reheater and the refrigerant flow downstream as an evaporator, Since the air which could be useful for the prevention from ozone layer depletion or global warming, and was heated, and the air by which cooling dehumidification was carried out are efficiently mixed by a fan, the air blowing off, Since there is no temperature fall as compared with suction air, it becomes the dehumidified air, there is moreover no temperature unevenness in air and it blows off, comfortable indoor environment can be made. The problem on reliability that dew will blow off from an outlet with blow-off air is cancelable. Since the dew which was transmitted to it and dehumidified the heat exchanger since the drain pan was installed in each heat exchanger lower part used as an evaporator is directly recoverable, reliability is securable.

[0102]Divide indoor heat exchanger, provide the 2nd flow control valve between them, and the refrigerant flow upstream of the 2nd flow control valve A reheater, Since it was characterized by intercepting said reheater and an evaporator thermally in the dehumidifying operation mode in which the refrigerant flow downstream is operated as an evaporator, more reheat heat exchanging quantity and evaporation heat exchange quantity are securable.

[0103]Since refrigerant inflow piping to the above-mentioned reheater installed in the upstream of the suction air flow to indoor heat exchanger and refrigerant inflow piping to the above-mentioned evaporator installed in the upstream of the suction air flow to indoor heat exchanger, The heated air and the air by which cooling dehumidification was carried out are mixed further more efficiently, there is no temperature unevenness, and since it blows off, comfortable indoor environment can be made.

[0104]Since the reheater has been arranged above a reheater, the ratio by the side of reheat and dehumidification can be kept moderate, preventing open dropping to a reheater from an evaporator, The heated air and the air by which cooling dehumidification was carried out are mixed further more efficiently, there is no temperature unevenness, and since it blows off, comfortable indoor environment can be made.

[0105]While dividing said indoor heat exchanger thermally and providing a flow control valve between them, Since it had the auxiliary heat exchanger thermally intercepted by the refrigerant flow upstream of the reheater in the refrigerant flow upstream of this 2nd flow control valve at the time of a reheater and the dehumidifying operation mode in which the refrigerant flow downstream is operated as an evaporator, Reheat heat exchanger capacity is expanded and reheat heat exchanging quantity increases, and it becomes possible to enlarge the capacity control range which carries out reheat dehumidification, preventing a room temperature fall. The opening space in an indoor unit can be utilized effectively, and miniaturization of an indoor unit is also attained. The indoor heat exchanger capability at the time of heating operation can usually be raised.

[0106]Since said auxiliary heat exchanger was installed in the air flow windward of said reheater, it can counter with air with a low temperature, a refrigerant can flow, and heat exchanging performance can be raised more.

[0107]Since the refrigerant passage of the auxiliary heat exchanger was made into one line, the indoor heat exchanger capability at the time of heating operation can usually be raised more.

[0108]Since the draft resistance of said auxiliary heat exchanger was made smaller than other heat exchangers, heat exchanging performance can be raised suppressing increase of the pressure loss by the side of ventilation.

[0109]In the air conditioner arranged so that it may have a compressor, indoor heat exchanger, the 1st flow control valve, and an outdoor heat exchanger, indoor heat exchanger may be applied to the back from the front face of an interior unit and a fan may be surrounded, While dividing said indoor heat exchanger and providing the 2nd flow control valve between them, Since it was characterized by using heat exchanger capacity of said reheater as 60 to 65% of indoor heat exchanger in the mode of operation as for which the refrigerant flow upstream of this 2nd flow control valve operates a reheater and the refrigerant flow downstream as an evaporator, a wide range latent heat sensible heat heat-exchanging-capacity control range is securable.

[0110]Since the porosity penetration material which is open for free passage to a refrigerant flow direction was used as a flow resistance object of the 1st flow control valve or the 2nd flow

control valve, Since the refrigerant flow sound which passes a flow control valve can be reduced substantially, a measure, such as twisting an insulator and a sound deadener around the circumference, is also unnecessary, and becomes the surroundings of a flow control valve with cost reduction further and construction material besides these becomes still more unnecessary, the recycling efficiency of an air conditioner also improves.

[0111]Arrangement or porosity penetration material is independently arranged for the porosity penetration material which is open for free passage to a refrigerant flow direction with the structure which puts an orifice between an orifice, this refrigerant flow upstream direction, a downstream direction, or an up-and-down flow direction in the 2nd flow control valve, Since it had the refrigerant passage which bypasses the 2nd flow control valve, and a means to open and close this bypass passage while making it act as a flow resistance object, while the refrigerant flow sound which passes the 2nd flow control valve is reduced substantially, the structure of the 2nd flow control valve is simplified and cost reduction can be planned.

[0112]Since it had a means to open and close an outdoor heat exchanger, the refrigerant passage which bypasses the 1st flow control valve, and this bypass passage, the capacity control range of reheat dehumidifying operation is expandable.

[0113]Since the heat exchanger to which heat exchange of the entrance line and compressor suction piping of the 2nd flow control valve is carried out in dehumidifying operation mode was provided, the refrigerant flow sound at the time of a refrigerant passing the 2nd flow control valve can be reduced substantially.

[0114]Since the container which stores liquid cooling intermediation was formed on the refrigerant circuit used as high voltage liquid at the time of heating operation, air conditioning heating can reduce substantially the refrigerant flow sound at the time of a refrigerant passing the 2nd flow control valve, while efficient operation is attained with the optimal refrigerant amount.

[0115]While having a means to detect the latent heat and sensible heat air conditioning load in the interior of a room in the dehumidifying operation mode in which the refrigerant flow upstream of the 2nd flow control valve operates a reheater and the refrigerant flow downstream as an evaporator, Since it had a means to adjust the blast weight to indoor heat exchanger based on the detection information on these air conditioning loads, according to the latent heat and sensible heat load in the interior of a room, latent heat and sensible heat heat exchanging quantity are controllable.

[0116]While having a means to detect the latent heat and sensible heat air conditioning load in the interior of a room in the dehumidifying operation mode in which the refrigerant flow upstream of the 2nd flow control valve operates a reheater and the refrigerant flow downstream as an evaporator, Since it had a means to adjust the blast weight to an outdoor heat exchanger based on the detection information on these air conditioning loads, according to the latent heat and sensible heat load in the interior of a room, latent heat and sensible heat heat exchanging quantity are controllable.

[0117]While having a means to detect the latent heat and sensible heat air conditioning load in the interior of a room in the dehumidifying operation mode in which the refrigerant flow upstream of the 2nd flow control valve operates a reheater and the refrigerant flow downstream as an evaporator, Since it had a means to adjust compressor number of rotations based on the detection information on these air conditioning loads, according to the latent heat and sensible heat load in the interior of a room, latent heat and sensible heat heat exchanging quantity are controllable.

[0118]While having a means to detect the latent heat and sensible heat air conditioning load in the interior of a room in the dehumidifying operation mode in which the refrigerant flow upstream of the 2nd flow control valve operates a reheater and the refrigerant flow downstream as an evaporator, Since it had a means to adjust the opening of the 1st flow control valve based on the detection information on these air conditioning loads, according to the latent heat and sensible heat load in the interior of a room, latent heat and sensible heat heat exchanging quantity are controllable.

[0119]While having a means to detect the latent heat and sensible heat air conditioning load in

the interior of a room in the dehumidifying operation mode in which the refrigerant flow upstream of the 2nd flow control valve operates a reheater and the refrigerant flow downstream as an evaporator, Since it had a means to adjust the opening of the 2nd flow control valve based on the detection information on these air conditioning loads, according to the latent heat and sensible heat load in the interior of a room, latent heat and sensible heat heat exchanging quantity are controllable.
[0120]While equipping the 1st flow control valve, the 2nd flow control valve, or the flow control valve of the both with a full-close function, using R290 or R32 as a refrigerant, Since it had a means to detect a refrigerant leak, and it had the means which carries out full close of these flow control valves when a refrigerant leak was detected, the refrigerant disclosure to the interior of a room to an inflammable refrigerant can be prevented, and the safety of apparatus can be secured.
[0121]
[Effect of the Invention]Since the air heated since it was constituted as explained above, and the air by which cooling dehumidification was carried out are efficiently mixed by a fan, this invention can make comfortable indoor environment.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a figure showing the composition of the indoor unit in a 1st embodiment in this invention.
[Drawing 2]It is a refrigerant circuit figure in a 1st embodiment in this invention.
[Drawing 3]It is a characteristic figure showing the operating state at the time of the air conditioning reheat dehumidifying operation in a 1st embodiment in this invention.
[Drawing 4]It is a characteristic figure showing the operating state at the time of the heating dehumidifying operation in a 1st embodiment in this invention.
[Drawing 5]It is a figure showing other composition of the indoor unit in a 1st embodiment in this invention.
[Drawing 6]It is a figure showing the composition of further others of the indoor unit in a 1st embodiment in this invention.
[Drawing 7]It is a figure showing the composition of the indoor unit in a 2nd embodiment in this invention.
[Drawing 8]It is a figure showing other composition of the indoor unit in a 2nd embodiment in this invention.
[Drawing 9]It is a figure showing the composition of further others of the indoor unit in a 2nd embodiment in this invention.
[Drawing 10]It is a figure showing the composition of the indoor unit in a 3rd embodiment in this invention.
[Drawing 11]It is a figure showing other composition of the indoor unit in a 3rd embodiment in

this invention.
[Drawing 12]It is a figure showing the composition of further others of the indoor unit in a 3rd embodiment in this invention.
[Drawing 13]It is a figure showing the composition of the 2nd flow control valve in a 4th embodiment in this invention.
[Drawing 14]It is a figure showing the composition of the 2nd flow control valve in a 5th embodiment in this invention.
[Drawing 15]It is a refrigerant circuit figure in a 5th embodiment in this invention.
[Drawing 16]It is a figure showing other composition of the 2nd flow control valve in a 5th embodiment in this invention.
[Drawing 17]It is a figure showing the composition of further others of the 2nd flow control valve in a 5th embodiment in this invention.
[Drawing 18]It is a refrigerant circuit figure in a 6th embodiment in this invention.
[Drawing 19]It is a characteristic figure showing the operating state at the time of the air conditioning reheat dehumidifying operation in a 6th embodiment in this invention.
[Drawing 20]It is a refrigerant circuit figure in a 7th embodiment in this invention.
[Drawing 21]It is a characteristic figure showing the operating state at the time of the air conditioning reheat dehumidifying operation in a 7th embodiment in this invention.
[Drawing 22]It is a refrigerant circuit figure in an 8th embodiment in this invention.
[Drawing 23]It is a lineblock diagram of the refrigerant circuit figure in a 9th embodiment in this invention and a sensor, and an actuator.
[Drawing 24]It is a figure showing the composition of the indoor unit in the conventional invention.
[Drawing 25]It is a figure showing other composition of the indoor unit in the conventional invention.
[Drawing 26]It is a figure showing the composition of the 2nd flow control valve in the conventional invention.
[Description of Notations]
5: Indoor fan
6, 7: Drain pan
10: The 2nd flow control valve
14: Auxiliary heat exchanger
17: Outdoor unit
18: Indoor unit
21: Compressor
23: Outdoor heat exchanger
24: The 1st flow control valve
25: The 1st indoor heat exchanger
27: The 2nd indoor heat exchanger
38: Sintered metal

[Translation done.]

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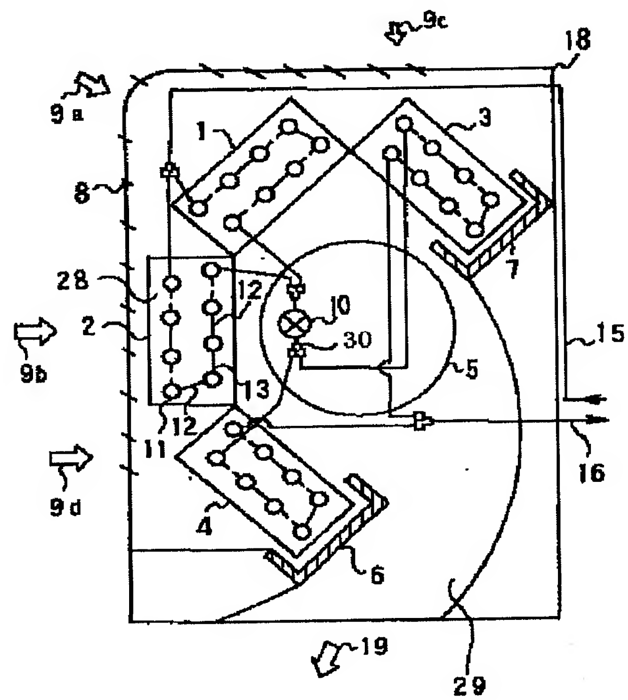
(54)【発明の名称】　空気調和機

(57)【要約】

【課題】　再熱除湿運転において、加熱された空気と除湿冷却された空気とに温度ムラがあった。

【解決手段】　室内熱交換器を室内機の前面から背面にかけて送風機５を囲むように配置した空気調和機において、室内熱交換器を分割しその間に第２流量制御弁１０を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器２５、冷媒流れ下流側を蒸発器２７として動作させる運転モードにて、この再熱器２５と蒸発器２７が熱的に遮断されているとともに、室内熱交換器の前面正面部分２もしくは前面上段斜め部分１を再熱器２５として作用させ、室内熱交換器の前面下段部分４および背面下段部分３を蒸発器２７として作用するような冷媒流路を構成した。



【特許請求の範囲】

【請求項１】　圧縮機、室内熱交換器、第１流量制御弁、室外熱交換器を備え、室内熱交換器を室内機の前面から背面にかけて送風機を囲むように配置した空気調和機において、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードにて、この再熱器と蒸発器が熱的に遮断されているとともに、前記室内熱交換器の正面もしくは前面上段斜め部分を再熱器として作用させ、前記室内熱交換器の前面下段部分および背面部分を蒸発器として作用させるような冷媒流路を構成したことを特徴とする空気調和機。

【請求項２】　前記室内熱交換器の前面下段部分を伝って除湿した露を回収する前面下段部分熱交換器用ドレンパンと、前記室内熱交換器の背面部分を伝って除湿した露を回収する背面熱交換器用ドレンパンとを備えたことを特徴とする請求項１記載の空気調和機。

【請求項３】　圧縮機、室内熱交換器、第１流量制御弁、室外熱交換器を備え、室内熱交換器を室内機の前面から背面にかけて送風機を囲むように配置すると共に前面及び上面から空気を吸い込む空気吸込グリルを備えた空気調和機において、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードにて、この再熱器と蒸発器が熱的に遮断されているとともに、前記室内熱交換器の背面部分を蒸発器として作用させ、この室内熱交換器の背面部分の隣に位置する前記室内熱交換器の前面斜め部分を再熱器として作用させるような冷媒流路を構成し、且つ前記室内熱交換器の背面部分を伝って除湿した露を回収する背面熱交換器用ドレンパンを備えたことを特徴とする空気調和機。

【請求項４】　前記再熱器への冷媒流入配管を室内熱交換器への吸込空気流れの上流側に配置し、前記蒸発器への冷媒流入配管を室内熱交換器への吸込空気流れの上流側に配置したことを特徴とする請求項１または３記載の空気調和機。

【請求項５】　前記室内熱交換器の再熱器を一体化したことを特徴とする請求項１乃至４の何れか記載の空気調和機。

【請求項６】　前記室内熱交換器を円弧状に配置したことを特徴とする請求項１乃至５の何れか記載の空気調和機。

【請求項７】　前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードの際、再熱器の冷媒流れ上流側に熱的に遮断された補助熱交換器を備えたことを特徴とする請求項１乃至６の何れか記載の空気調和機。

【請求項８】　前記補助熱交換器を前記再熱器の空気流れ風上側に設置したことを特徴とする請求項７記載の空気調和機。

【請求項９】　前記補助熱交換器の通風抵抗を他の熱交換器より小さくしたことを特徴とする請求項７または８記載の空気調和機。

【請求項１０】　冷媒としてＲ４１０ＡまたはＲ３２またはＲ２９０を用いたことを特徴とする、請求項１乃至９の何れか記載の空気調和機。

【請求項１１】　冷媒としてＲ４１０ＡまたはＲ３２またはＲ２９０を用い補助熱交換器の冷媒流路を一系統としたことを特徴とする請求項７乃至９の何れか記載の空気調和機。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、冷凍サイクルの凝縮熱を室内空気への加熱源として利用する空気調和機において、温度と湿度の制御性を高める空気調和機に関するものである。

【０００２】

【従来の技術】従来の空気調和機ににおいては、主として回転数可変型圧縮機等が用いられ、空調負荷の変動に対応している。しかし冷房低能力運転時は圧縮機回転数が低下するものの、蒸発温度も上昇して室内空気の露点温度以上となり、除湿できないという問題点があった。

【０００３】冷房低能力運転時の除湿能力を向上させる従来技術として、特開平９－４２７０６の図２４に示す空気調和機がある。この装置によると、圧縮機、四方弁、室内熱交換器、第１流量制御弁、室外熱交換器を備え、室内熱交換器を室内機の前面から背面にかけて送風機を囲むように配置した空気調和機において、前記室内熱交換器を熱的に分割しその間に第２流量制御弁１０を設けるとともに、この第２流量制御弁１０の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードにて、除湿能力を確保している。この時、前面上段から背面に設置された熱交換器が再熱器として作用している。

【０００４】また他の従来技術として、特開平１０－８９８０３の図２５に示す空気調和機がある。圧縮機、四方弁、室内熱交換器、第１流量制御弁、室外熱交換器を備え、室内熱交換器を室内機の前面から背面にかけて送風機を囲むように配置した空気調和機において、前記室内熱交換器を熱的に分割しその間に第２流量制御弁１０を設けるとともに、この第２流量制御弁１０の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードを持つとともに、この時再熱器の冷媒流れ上流側に補助熱交換器１４を設置し、除湿能力を確保している。

【０００５】

【発明が解決しようとする課題】しかし特開平９－４２

７０６や特開平１０－８９８０３においては、背面熱交換器が壁面に近いところに設置されているため、空気の吸込抵抗が大きく、背面熱交換器の通過風量が少ないという問題点がある。従って再熱器となる背面熱交換器での吸込空気流量が少なく、再熱熱交換量が確保できないという問題点がある。また背面熱交換器での吸込空気流量が少ないため、再熱器を通って加熱された空気が、蒸発器となる前面熱交換器を通過し除湿冷却された空気と、うまく混合されず、吹き出し空気に温度ムラが生じ、快適性上問題となる。また蒸発器を通過した低温の空気が、再熱された高温の空気と混合されないまま接触すると露が発生し、露がドレンパンに届かずに、そのまま空気吹出口から滴下してしまうという信頼性上の問題点がある。また混合度合いが低い状態のまま送風機を通過すると、送風機により混合された際に露が発生し、送風機に付着しそのまま空気吹出口から滴下してしまうという信頼性上の問題点がある。また加熱された空気と除湿冷却された空気がうまく混合されないと、風路壁面など局所的に低温の部分が生じ、ここでも露が発生して、そのまま空気吹出口から滴下してしまうという信頼性上の問題点がある。

【０００６】また、従来の空気調和機においては冷媒としてＲ２２が使用されていたが、オゾン層破壊防止のため、Ｒ４１０Ａなどへの代替化が進行中である。Ｒ４１０ＡはＲ２２より動作圧力が高くなるため、第２流量制御弁での差圧も大きくなり、冷媒流動音がより大きくなるという問題点が生じる。

【０００７】本発明は、上に述べたような問題点を解決するためになされたものであり、冷凍サイクルの凝縮熱を室内空気への加熱源として利用する空気調和機において、温度と湿度の制御性を高めることを目的とする。

【０００８】

【課題を解決するための手段】本発明にかかる空気調和機は、圧縮機、室内熱交換器、第１流量制御弁、室外熱交換器を備え、室内熱交換器を室内機の前面から背面にかけて送風機を囲むように配置した空気調和機において、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードにて、この再熱器と蒸発器が熱的に遮断されているとともに、前記室内熱交換器の正面もしくは前面上段斜め部分を再熱器として作用させ、前記室内熱交換器の前面下段部分および背面部分を蒸発器として作用させるような冷媒流路を構成したものである。

【０００９】また、前記室内熱交換器の前面下段部分を伝って除湿した露を回収する前面下段部分熱交換器用ドレンパンと、前記室内熱交換器の背面部分を伝って除湿した露を回収する背面熱交換器用ドレンパンとを備えたものである。

【００１０】また、圧縮機、室内熱交換器、第１流量制御弁、室外熱交換器を備え、室内熱交換器を室内機の前面から背面にかけて送風機を囲むように配置すると共に前面及び上面から空気を吸い込む空気吸込グリルを備えた空気調和機において、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードにて、この再熱器と蒸発器が熱的に遮断されているとともに、前記室内熱交換器の背面部分を蒸発器として作用させ、この室内熱交換器の背面部分の隣に位置する前記室内熱交換器の前面斜め部分を再熱器として作用させるような冷媒流路を構成し、且つ前記室内熱交換器の背面部分を伝って除湿した露を回収する背面熱交換器用ドレンパンを備えたものである。

【００１１】また、前記再熱器への冷媒流入配管を室内熱交換器への吸込空気流れの上流側に配置し、前記蒸発器への冷媒流入配管を室内熱交換器への吸込空気流れの上流側に配置したものである。

【００１２】また、前記室内熱交換器の再熱器を一体化したものである。

【００１３】また、前記室内熱交換器を円弧状に配置したものである。

【００１４】また、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードの際、再熱器の冷媒流れ上流側に熱的に遮断された補助熱交換器を備えたものである。

【００１５】また、前記補助熱交換器を前記再熱器の空気流れ風上側に設置したものである。

【００１６】また、前記補助熱交換器の通風抵抗を他の熱交換器より小さくしたものである。

【００１７】また、冷媒としてＲ４１０ＡまたはＲ３２またはＲ２９０を用いたものである。

【００１８】また、冷媒としてＲ４１０ＡまたはＲ３２またはＲ２９０を用い補助熱交換器の冷媒流路を一系統としたものである。

【００１９】

【発明の実施の形態】実施の形態１．本発明の第１の実施形態による空気調和機を図１、２に示す。図１は室内ユニットの断面図で、図２は冷媒回路図である。図１において、室内ユニット内に組み込まれた室内熱交換器は例えばプレートフィンチューブ型熱交換器で多段曲げ構造となっており、前面から背面にかけて送風機５（貫流送風機の例を示す）を囲むように設置され、第２流量制御弁１０を備えている。１１は伝熱管、１２は手前側の伝熱管接続配管、１３は奥側の伝熱管接続配管、２８は伝熱フィンである。この室内熱交換器は前面下段部分４、前面正面部分２、前面上段斜め部分１、背面部分３の４段曲げ構造であり、各々の部分は熱的に遮断されて

いる。６は前面下段部分熱交換器用ドレンパン、７は背面熱交換器用ドレンパン、８は空気吸込グリル、９は吸込空気流れ方向、２９は空気吹出口、１９は吹出空気流れ方向である。９の方向より空気吸込グリル８から吸い込まれた空気は、送風機５によって吸引され、吸込空気流れ方向９ｄから前面下段部分４、９ｂから前面正面部分２、９ａから前面上段斜め部分１、９ｃから背面部分３の各々４カ所を通って熱交換し、空気吹出口２９より、１９の方向に吹き出される。図２に示す冷媒回路図では、室外ユニット１７は、圧縮機２１、四方弁２２、室外熱交換器２３、第１流量制御弁２４より構成され、室内ユニット１８の室内熱交換器は、熱的に分割された第１室内熱交換器２５と第２室内熱交換器２７より構成され、その間に第２流量制御弁１０を設けている。図１に示す室内熱交換器のパスパターンでは、図２に示す四方弁２２が冷房再熱除湿運転時の方向となった時、すなわち冷媒流れ方向が実線の矢印方向時、冷媒入口配管が１５、冷媒出口配管が１６となり、それぞれ図２における第１流量制御弁２４、四方弁２２に接続されている例を示している。再熱器となる室内熱交換器の第１室内熱交換器２５は、第２流量制御弁の冷媒流れ上流側となる前面上段斜め部分１と前面正面部分２に配置され、蒸発器となる室内熱交換器の第２室内熱交換器２７は、第２流量制御弁の冷媒流れ下流側となる背面部分３と前面下段部分４に配置され、蒸発器の下側にも再熱器が配置された構造となっている。以上、図１の室内ユニット１８の作用、および図２の冷媒回路において冷房再熱除湿運転時の動作を以下に説明する。

【００２０】図２において、通常冷房運転時は第２流量制御弁１０を全開とし、第１流量制御弁２４で減圧する冷凍サイクルとなる。一方、冷房再熱除湿運転時は、第１流量制御弁２４の開度を開き気味とし、第２流量制御弁１０を主たる減圧装置として使用する冷凍サイクルとなる。この冷房再熱除湿運転時の冷凍サイクルにおける、圧力－エンタルピ線図を図３に示す。図３中のＡ～Ｆは、図２中の冷媒回路におけるＡ～Ｆにそれぞれ対応し、冷房再熱除湿運転時の冷媒流れ方向を図２中の実線の矢印で示す。圧縮機２１から吐出され、四方弁２２を通った冷媒は、Ａ点から室外熱交換器２３にて凝縮しＢ点となり、第１流量制御弁２４で若干減圧されＣ点となり、第１室内熱交換器２５に流入する。この時第１室内熱交換器２５は再熱器として作用し、Ｄ点まで再凝縮する。この後第２流量制御弁１０を通ってＥ点まで減圧され、第２室内熱交換器２７に流入する。この時第２室内熱交換器２７は蒸発器として作用し、Ｆ点まで蒸発して、圧縮機２１の吸入に戻る冷凍サイクルとなる。この時室内ユニット１８では、第２室内熱交換器２７で冷却除湿された空気と第１室内熱交換器２５で加熱された空気が混合して吹き出す。よってこの冷房再熱除湿運転時には、室温の低下を防ぎながら除湿を行うことができる。

【００２１】前述した再熱除湿運転時には、図１に示すように、再熱器となる第１室内熱交換器２５が、第２流量制御弁の冷媒流れ上流側となる前面上段斜め部分１と前面正面部分２に送風機５を囲むように配置され、蒸発器となる室内熱交換器の第２室内熱交換器２７が、第２流量制御弁の冷媒流れ下流側となる背面部分３と前面下段部分４に送風機５を囲むように配置されているので、室内ユニット１８の斜め上面９ａや前面９ｂから吸い込み加熱された空気と、背面９ｃや前面下部９ｄから冷却除湿された空気とが送風機５により効率よく混合される。特に従来例と比較して、背面部分３を蒸発器として作用させることにより、背面部分３を通過し除湿冷却された空気９ｃと、前面上段斜め部分１を通過し加熱された空気９ａとが特によく混合される。従って吹出口２９から吹き出される空気１９は、吸込空気と比較して温度低下がなく除湿された空気となり、しかも空気に温度ムラがなく吹き出されるため、非常に快適な室内環境を作ることができる。

【００２２】また、加熱された空気９ａ、９ｂと冷却除湿された空気９ｃ、９ｄが、送風機５により効率よく混合されるため、送風機５や吹出口２９の壁面等に温度ムラがなくなり、局所的に冷却された部分に露が付着し、吹出し空気とともに吹出口２９から露が吹き出してしまうといった、信頼性上の問題点を解消できる。また、加熱された空気９ａ、９ｂの両側から冷却除湿された空気９ｃと９ｄとが混合されるから、空気の混合が２箇所で行なえ、従来のような冷却除湿された空気と加熱された空気の大きな固まり同士が接触することによりその界面で露が発生し、吹出し空気とともに吹出口２９から露が吹き出してしまうといった、信頼性上の問題点も解消できる。

【００２３】また、蒸発器となる室内熱交換器の第２室内熱交換器２７が、背面部分３と前面下段部分４に送風機５を囲むように配置されており、それぞれの熱交換器下部にドレンパン６、７を設置しているので、吹出し空気とともに吹出口２９から露が吹き出してしまうことなく、また、第１室内熱交換器２５が第２室内熱交換器から発生する露の滴下を受けることなく熱交換器３、４を伝って除湿した露を直接ドレンパン６、７で回収することができるので、信頼性を確保することができる。

【００２４】図２に、暖房運転時の冷媒流れ方向を点線の矢印で示す。暖房除湿運転での冷凍サイクルにおける、圧力－エンタルピ線図を図４に示す。図４中のＡ～Ｆは、図２中の冷媒回路におけるＡ～Ｆにそれぞれ対応する。圧縮機２１から吐出され、四方弁２２を通った冷媒は、Ｆ点から第２室内熱交換器２７にて凝縮しＥ点となり、第２流量制御弁１０で減圧されＤ点となり、第１室内熱交換器２５に流入する。この時第２室内熱交換器２７は再熱器として作用し、第１室内熱交換器２５は蒸

発器として作用する。この後Ｃ点を通って第１流量制御弁２４に流入しＢ点まで減圧され、室外熱交換器２３に流入する。そしてＡ点まで再蒸発して、圧縮機２１の吸入に戻る冷凍サイクルとなる。この時室内ユニット１８では、第１室内熱交換器２５で冷却除湿された空気と第２室内熱交換器２７で加熱された空気が混合して吹き出す。よってこの暖房時も除湿しながら運転を行うことができる。

【００２５】本発明の第１の実施形態による他の実施例となる空気調和機を図５に示す。図５は室内ユニットの断面図で、記号は図１と同様であり、冷媒回路も図２と同様である。図１における再熱器となる第１室内熱交換器２５は、第２流量制御弁の冷媒流れ上流側となる前面上段斜め部分１と前面正面部分２に配置されていたが、図５においては、これを再熱器として一体化し、前面斜め部分２に一体配置したことを特徴とする。蒸発器となる第２室内熱交換器２７は、図１と同様に第２流量制御弁の冷媒流れ下流側となる背面部分３と前面下段部分４に配置されている。従って再熱器を一体化したことにより、図１より低コスト化を図ることができる。また、室内熱交換器を円弧状に配置したり、図１よりさらに多数に分割した多段曲げ構造とし、再熱器と蒸発器の間を熱的に遮断する、例えば伝熱管１１の段間の伝熱フィン２８に切り込みを入れフィンでの熱伝導を防止する等の工夫をすれば、本発明の目的は達成される。

【００２６】本発明の第１の実施形態によるさらに他の実施例となる空気調和機を図６に示す。図６は室内ユニットの断面図で、記号は図１と同様であり、冷媒回路も図２と同様である。図１では再熱器となる第１室内熱交換器２５の熱交換器容量と蒸発器となる第２室内熱交換器２７の熱交換器容量が等しい例、すなわち前面下段部分４、前面正面部分２、前面上段斜め部分１、背面部分３、とも２列４段のプレートフィンチューブ熱交換器で構成する例を示したが、図６においては、再熱器となる第１室内熱交換器２５の熱交換器容量と蒸発器となる第２室内熱交換器２７の熱交換器容量が異なる例、すなわち前面下段部分４は２列３段、前面正面部分２は２列４段、前面上段斜め部分１は２列５段、背面部分３は２列４段、のプレートフィンチューブ熱交換器で構成した。図６に示すような構成とすることにより、想定される室内の潜熱顕熱負荷に応じて、再熱器熱交換量と蒸発熱交換量の比を変更しても、冷房再熱除湿運転時には、室温の低下を防ぎながら除湿を行うことができる。また、パスパターン可変アクチュエータの導入などの冷媒流路の構成の工夫により、室内の潜熱顕熱負荷の変動に応じて、再熱器熱交換量と蒸発熱交換量の比を変更してもよい。

【００２７】実施の形態２．本発明の第２の実施形態による空気調和機の室内ユニットの断面図を図７に示す。記号は図１と同じであり、またこの空気調和機の冷媒回路は図２と同様である。図７の室内熱交換器は、例えばプレートフィンチューブ型熱交換器で多段曲げ構造となっており、前面から背面にかけて送風機５を囲むように設置され、室内ユニットに第２流量制御弁１０を備えている。図７に示す室内熱交換器は４段曲げ構造の例であり、各々の部分は熱的に遮断されている。また室内熱交換器のパスパターンと冷媒流れ方向は冷房再熱除湿運転時の場合を示している。この時蒸発器となる第２室内熱交換器２７は背面部分３と前面下段部分４、再熱器となる第１室内熱交換器２５は前面正面部分２、前面上段斜め部分１である。そして冷房再熱除湿運転の際、再熱器となる熱交換器の冷媒流れ上流側に熱的に遮断された補助熱交換器１４を備えている。以上の、図７の室内ユニット１８の動作、および図２の冷媒回路において冷房再熱除湿運転時の動作を以下に説明する。

【００２８】第２の実施形態においても、第１の実施形態と同様に、図２において、通常冷房運転時は第２流量制御弁１０を全開とし、第１流量制御弁２４で減圧する冷凍サイクルとなる。一方、冷房再熱除湿運転時は、第１流量制御弁２４を開き気味とし、第２流量制御弁１０を主たる減圧装置として使用する冷凍サイクルとなる。この冷房再熱除湿運転時の冷凍サイクルにおける、圧力－エンタルピ線図も第１の実施形態と同様の図３となる。また暖房除湿運転での冷凍サイクルは、第１の実施形態と同様になる。

【００２９】一般に再熱器となる熱交換器の容量を大きく設定すれば、再熱熱交換量を大きくすることができ、室温低下を防ぎながら再熱除湿する能力制御範囲を大きくすることができる。従って本実施例では、冷房再熱除湿運転時、再熱器となる冷媒流れ上流側に補助熱交換器１４を備えたことにより再熱熱交換器容量が拡大して再熱熱交換量が増加し、室温低下を防ぎながら再熱除湿する能力制御範囲を大きくすることが可能となる。また、単に再熱熱交換器容量を拡大すると室内ユニット１８寸法が大きくなるが、本実施例のように設置すれば、室内ユニット１８内の空隙スペースを有効に活用することができ、室内ユニット１８のコンパクト化も可能となる。

【００３０】また、本実施例においては、第１の実施の形態と同様に、蒸発器となる室内熱交換器の第２室内熱交換器２７が、第２流量制御弁の冷媒流れ下流側となる背面部分３と前面下段部分４に送風機５を囲むように配置されているので、室内ユニット１８の前面斜め９ａや正面９ｂから吸込加熱された空気と、背面９ｃや前面下部９ｄから吸い込み冷却除湿された空気が送風機５により効率よく混合される。特に従来例と比較して、背面部分３を蒸発器として作用させることにより、背面部分３を通過し除湿冷却された空気９ｃと、前面上段斜め部分１を通過し加熱された空気９ａとが特によく混合される。従って吹出口２９から吹き出される空気１９は、吸込空気と比較して温度低下がなく除湿された空気とな

り、しかも空気に温度ムラがなく吹き出されるため、非常に快適な室内環境を作ることができる。

【００３１】また、冷却除湿された空気と加熱された空気が送風機５により効率よく混合されるため、送風機５や吹出口２９の壁面等に温度ムラがなくなり、局所的に冷却された部分に露が付着し、吹出し空気とともに吹出口２９から露が吹き出してしまうといった、信頼性上の問題点を解消できる。また、冷却除湿された空気と加熱された空気が接触することによりその界面で露が発生し、吹出し空気とともに吹出口２９から露が吹き出してしまうといった、信頼性上の問題点も解消できる。

【００３２】また、蒸発器となる室内熱交換器の第２室内熱交換器２７が、背面部分３と前面下段部分４に送風機５を囲むように配置されており、それぞれの熱交換器下部にドレンパン６、７を設置しているので、吹出し空気とともに吹出口２９から露が吹き出してしまうことなく、熱交換器を伝って除湿した露を直接回収することができるので、信頼性を確保することができる。

【００３３】また本実施例では、通過風速が一番大きい前面上段斜め部分１熱交換器の空気流れ９ａ上流側に補助熱交換器１４を備えているので、再熱熱交換器容量がより拡大して再熱熱交換量が増加し、室温低下を防ぎながら再熱除湿する能力制御範囲を大きくすることが可能となる。

【００３４】なお、補助熱交換器１４を背面部分３熱交換器など蒸発器として作用する熱交換器の空気流れ上流側に設置した場合は、加熱した空気を冷却することとなり、空気調和機のシステム効率が低下し得策でない。また補助熱交換器１４を前面正面部分２熱交換器の空気流れ上流側に設置した場合は、室内ユニット１８の奥行き寸法が増大し、室内ユニット１８のコンパクト化に逆行し、得策ではない。また同様に前面下段部分４熱交換器の空気流れ上流側に設置した場合は、前面下段部分４熱交換器が蒸発器として作用するため、加熱した空気を冷却することとなり、空気調和機のシステム効率が低下し得策でない。

【００３５】次に本実施例における通常暖房運転時の動作について説明する。暖房運転時室内熱交換器は凝縮器となるが、凝縮熱交換量を向上させるためには凝縮器出口での冷媒過冷却度を十分にとり、冷媒エンタルピを拡大する必要がある。しかし、過冷却域では冷媒は液状態であるとともに、冷媒温度も凝縮温度より低い。このため、過冷却域では伝熱管内の冷媒流速を上げて冷媒熱伝達率を高めるとともに、過冷却域での伝熱管を空気流れの風上側に設置して、熱交換前の比較的温度の低い空気と熱交換させて、凝縮熱交換量向上を図る必要がある。また過冷却部分を飽和部分と熱的に遮断してやることにより、伝熱フィンを熱伝導して熱交換してしまう空調に寄与しない熱量を減らす必要がある。またさらには、凝縮器入口の高温ガス冷媒域での伝熱管配置を空気と対向流としてやる必要がある。図７において、補助熱交換器１４は、暖房運転時凝縮器の出口側となる部分に設置し、かつ前面上段斜め部分１熱交換器の空気流れ上流側に設置されており、冷媒流路を一系統としている。従って前述したように、伝熱管内の冷媒流速が十分に早くなり冷媒熱伝達率が高くなり、空気との温度差も十分に取れて、過冷却熱交換器として十分な性能を発揮することができる。また、補助熱交換器１４を前面上段斜め部分１熱交換器とは別体とし熱的に遮断して設置したので、伝熱フィン２８間を熱伝導して熱交換してしまう空調に寄与しない熱量を減らすことができ、熱交換性能を向上させることができる。またさらには、図７においては暖房運転時凝縮器入口となる高温ガス冷媒が流れる配管を空気流れの下流側に設置し、温度が低い空気と対向して流れているので、熱交換性能をより向上させることができる。

【００３６】なお、図７では過冷却熱交換器となる補助熱交換器１４の冷媒流路が一系統で、凝縮器入口となる高温ガス冷媒での冷媒流路が二系統の場合を示したが、流路数は冷房運転も含めた冷媒熱伝達率と冷媒圧力損失を鑑み、熱交換性能に与える効果が最大となるよう最適値に設定されるべきであり、主として伝熱管径に応じて流路数は設定される。

【００３７】また本実施例では、通過風速が一番大きい前面上段斜め部分１熱交換器の空気流れ９ａ上流側に補助熱交換器１４を配置したが、通風抵抗は増加し風量が低下する恐れがあるので、補助熱交換器１４は通風抵抗が小さい物にする必要がある。すなわち、伝熱フィンのフィンピッチを拡大したり、伝熱フィン幅を小さくしたり、あるいは室内熱交換器に伝熱性能を向上させるために設けている伝熱フィン切り起こしを行わない仕様にしたり、室内熱交換器より伝熱管径を細くしたりしてもよい。

【００３８】また、本発明の第２の実施形態による他の実施例となる空気調和機を図８に示す。図８は室内ユニットの断面図で、記号は図７と同様であり、冷媒回路も図２と同様である。図８における再熱器となる第１室内熱交換器２５は、第２流量制御弁の冷媒流れ上流側となる前面上段斜め部分１と前面正面部分２に配置されていたが、図８においては、これを再熱器として一体化し、前面斜め部分２に一体配置し、その空気流れ上流側に補助熱交換器１４を設置したことを特徴とする。蒸発器となる第２室内熱交換器２７は、図７と同様に第２流量制御弁の冷媒流れ下流側となる背面部分３と前面下段部分４に配置されている。従って再熱器となる熱交換器を一体化したことにより、図７より低コスト化を図ることができる。また、室内熱交換器を円弧状に配置したり、図７よりさらに多数に分割した多段曲げ構造とし、再熱器と蒸発器の間を熱的に遮断する、例えば伝熱管１１の段間の伝熱フィン２８に切り込みを入れフィンでの熱伝導

を防止する等の工夫をすれば、本発明の目的は達成される。
【００３９】本発明の第２の実施形態によるさらに他の実施例となる空気調和機を図９に示す。図９は室内ユニットの断面図で、記号は図８と同様であり、冷媒回路も図２と同様である。図９においては、補助熱交換器１４を付加し再熱器となる第１室内熱交換器２５の熱交換器容量と蒸発器となる第２室内熱交換器２７の熱交換器容量が異なる例、すなわち前面下段部分４は２列３段、前面正面部分２は２列４段、前面上段斜め部分１は２列５段、背面部分３は２列４段、のプレートフィンチューブ熱交換器で構成した。図９に示すような構成とすることにより、想定される室内の潜熱顕熱負荷に応じて、再熱器熱交換量と蒸発熱交換量の比を変更しても、冷房再熱除湿運転時には、室温の低下を防ぎながら除湿を行うことができる。また、パスパターン可変アクチュエータの導入などの冷媒流路の構成の工夫により、室内の潜熱顕熱負荷の変動に応じて、再熱器熱交換量と蒸発熱交換量の比を変更してもよい。
【００４０】以上、第１、２の実施形態に述べた室内ユニット１８においては、室内熱交換器全てを、再熱器または蒸発器として用いる例を示したが、冷媒流路の構成により多分割構造の一部の熱交換器のみを使用して、再熱器または蒸発器として作用させても室温低下がない除湿した空気を吹き出すことができる。しかし能力制御範囲が狭くなるという欠点が存在し、適切ではない。
【００４１】なお以上、第１、２の実施形態に述べた空調機に用いる冷媒としてＲ４１０ＡもしくはＲ３２もしくはＲ２９０を使用した場合の特徴について説明する。従来空気調和機に用いられていたＲ２２冷媒に対して、Ｒ４１０ＡやＲ３２やＲ２９０冷媒はオゾン破壊係数が０であり、とくにＲ３２やＲ２９０は地球温暖化係数もＲ２２やＲ４１０Ａより小さく、地球環境に優しい冷媒という特徴がある。加えて、Ｒ４１０ＡやＲ３２やＲ２９０はＲ２２と比較して冷媒圧力損失が小さいという特性を持つ。Ｒ４１０Ａ、Ｒ２９０はＲ２２と比較して冷媒圧力損失が７０％、Ｒ３２はＲ２２と比較して冷媒圧力損失が５０％となる。従って、Ｒ４１０ＡやＲ３２やＲ２９０では蒸発器入口温度と出口温度の温度勾配が小さくなり、蒸発器温度が均一化されるという特性を持つ。従って蒸発器を出て冷却除湿された空気には温度ムラがなく、加熱された空気と非常によく混合することになり、温度低下がなく除湿された空気が、温度ムラがなく吹き出されるため、非常に快適な室内環境を作ることができるという、本実施例の目的により合致した冷媒であると言える。
【００４２】また第２の実施形態にて、補助熱交換器１４を設置し、冷媒流路を一系統で構成した例を示したが、Ｒ４１０ＡやＲ３２やＲ２９０はＲ２２と比較して冷媒圧力損失が小さいという特性を持つため、冷媒流速向上による冷媒管内熱伝達率向上効果が大きく、各種運転モードにおいても熱交換能力の向上を図ることができる。通常図１、５、６または７のように蒸発器を前面下部と背面のように分散させたり、補助熱交換器を設ける等、複雑な構成にすると配管引き回しのために熱ロスが発生するが、上記Ｒ４１０ＡやＲ３２やＲ２９０のように冷媒圧力損失が小さい冷媒を用いれば、熱ロスの少ない状態で快適な空調環境を提供することが可能になる。
【００４３】また冷媒としては、ＨＦＣ系（Ｒ１１６、Ｒ１２５、Ｒ１３４ａ、Ｒ１４、Ｒ１４３ａ、Ｒ１５２ａ、Ｒ２２７ｅａ、Ｒ２３、Ｒ２３６ｅａ、Ｒ２３６ｆａ、Ｒ２４５ｃａ、Ｒ２４５ｆａ、Ｒ３２、Ｒ４１、ＲＣ３１８などや、これら冷媒の数種の混合冷媒Ｒ４０７Ａ、Ｒ４０７Ｂ、Ｒ４０７Ｃ、Ｒ４０７Ｄ、Ｒ４０７Ｅ、Ｒ４１０Ｂ、Ｒ４０４Ａ、Ｒ５０７Ａ、Ｒ５０８Ａ、Ｒ５０８Ｂなど）、ＨＣ系（ブタン、イソブタン、エタン、プロパン、プロピレンなどや、これら冷媒の数種の混合冷媒）、自然冷媒（空気、炭酸ガス、アンモニアなどや、これら冷媒の数種の混合冷媒）、またこれらＨＦＣ系、ＨＣ系、自然冷媒などの数種の混合冷媒など、どんな冷媒を用いてもオゾン破壊係数が０であり、第１、２の実施形態に述べた再熱除湿運転時の効果は発揮される。
【００４４】実施の形態３．本発明の第３の実施形態による空気調和機の室内ユニットの断面図を図１０に示す。記号は図１と同じであり、またこの空気調和機の冷媒回路は図２と同様である。図１０の室内熱交換器は、例えばプレートフィンチューブ型熱交換器で多段曲げ構造となっており、前面から背面にかけて送風機５を囲むように設置され、室内ユニットに第２流量制御弁１０を備えている。図１０に示す室内熱交換器は、伝熱管が２列に配置された４段曲げ構造の例である。冷媒はＲ４１０ＡもしくはＲ３２を使用する。図１０において、室内熱交換器のパスパターンと冷媒流れ方向は冷房再熱除湿運転時の場合を示す。この時再熱器となる第１室内熱交換器２５は、前面正面部分２、前面上段斜め部分１、蒸発器となる第２室内熱交換器２７は背面部分３と前面下段部分４である。以上の、図１０の室内ユニット１８の動作、および図２の冷媒回路において冷房再熱除湿運転時の動作を以下に説明する。
【００４５】第３の実施形態においても、第１の実施形態と同様に、図２において、通常冷房運転時は第２流量制御弁１０を全開とし、第１流量制御弁２４で減圧する冷凍サイクルとなる。一方、冷房再熱除湿運転時は、第１流量制御弁２４を全開とし、第２流量制御弁１０を主たる減圧装置として使用する冷凍サイクルとなる。この時の冷凍サイクルにおける、圧力－エンタルピ線図も第１の実施形態と同様の図３となる。また暖房除湿運転での冷凍サイクルは、第１の実施形態と同様になる。
【００４６】図１０における冷房再熱除湿運転時の冷媒

および空気の流れ方について、以下に説明する。１５の方向から室内熱交換器に流入した冷媒は、再熱器となる前面上段斜め部分１熱交換器に流入した後分岐され、前面正面部分２熱交換器の後列側伝熱管と、背面部分３熱交換器の後列側伝熱管に流入し、再熱器として動作する。この後冷媒は合流して第２流量制御弁１０に流入して減圧され、蒸発器として作用する前面正面部分２熱交換器の前列側伝熱管と、背面部分３熱交換器の前列側伝熱管に流入して、前面下段部分４熱交換器に流入後、１６より室内熱交換器から流出していく。また空気流れは、それぞれ９ａ、９ｂ、９ｃ、９ｄの方向より、前面上段斜め部分１、前面正面部分２、背面部分３、前面下段部分４の各熱交換器を通過して熱交換し、送風機５を通過して、吹出口２９より１９の方向に流出する。この時９ｂ、９ｃを通過する空気は、前面正面部分２熱交換器の前列側伝熱管と背面部分３熱交換器の前列側伝熱管により冷却除湿された後、前面正面部分２熱交換器の後列側伝熱管と背面部分３熱交換器の後列側伝熱管により加熱されるので、冷却除湿された空気と加熱された空気が非常によく混合して吸込空気と比較して温度低下がなく除湿された空気となり、しかも空気に温度ムラがなく吹き出されるため、非常に快適な室内環境を作ることができる。また、前面正面部分２熱交換器と背面部分３熱交換器に加えて、前面上段斜め部分１熱交換器を再熱器とし、前面下段部分４熱交換器を蒸発器として作用させるため、熱交換器容量として十分な量を確保しており、冷房再熱除湿運転時も十分な空調能力を発揮することができる。

【００４７】また、本実施例に冷媒としてＲ４１０ＡもしくはＲ３２もしくはＲ２９０を使用した場合の特徴について説明する。従来空気調和機に用いられていたＲ２２冷媒に対して、Ｒ４１０ＡやＲ３２やＲ２９０冷媒はオゾン破壊係数が０であり、とくにＲ３２やＲ２９０は地球温暖化係数もＲ２２やＲ４１０Ａより小さく、地球環境に優しい冷媒という特徴がある。加えて、Ｒ４１０ＡやＲ３２やＲ２９０はＲ２２と比較して冷媒圧力損失が小さいという特性を持つ。Ｒ４１０Ａ、Ｒ２９０はＲ２２と比較して冷媒圧力損失が７０％、Ｒ３２はＲ２２と比較して冷媒圧力損失が５０％となる。従って、Ｒ４１０ＡやＲ３２やＲ２９０では蒸発器入口温度と出口温度の温度勾配が小さくなり、蒸発器温度が均一化されるという特性を持つ。従って蒸発器を出て冷却除湿された空気には温度ムラがなく、加熱された空気と非常によく混合することになり、温度低下がなく除湿された空気が、温度ムラがなく吹き出されるため、非常に快適な室内環境を作ることができるという、本実施例の目的により合致した冷媒であると言える。また冷媒としては、ＨＦＣ系（Ｒ１１６、Ｒ１２５、Ｒ１３４ａ、Ｒ１４、Ｒ１４３ａ、Ｒ１５２ａ、Ｒ２２７ｅａ、Ｒ２３、Ｒ２３６ｅａ、Ｒ２３６ｆａ、Ｒ２４５ｃａ、Ｒ２４５ｆａ、Ｒ３２、Ｒ４１、ＲＣ３１８などや、これら冷媒の数種の混合冷媒Ｒ４０７Ａ、Ｒ４０７Ｂ、Ｒ４０７Ｃ、Ｒ４０７Ｄ、Ｒ４０７Ｅ、Ｒ４１０Ｂ、Ｒ４０４Ａ、Ｒ５０７Ａ、Ｒ５０８Ａ、Ｒ５０８Ｂなど）、ＨＣ系（ブタン、イソブタン、エタン、プロパン、プロピレンなどや、これら冷媒の数種の混合冷媒）、自然冷媒（空気、炭酸ガス、アンモニアなどや、これら冷媒の数種の混合冷媒）、またこれらＨＦＣ系、ＨＣ系、自然冷媒などの数種の混合冷媒など、どんな冷媒を用いてもオゾン破壊係数が０であり、その効果は発揮される。

【００４８】第３の実施形態の別実施例による空気調和機の室内ユニットの断面図を図１１に示す。記号は図１０と同じであり、またこの空気調和機の冷媒回路は図２と同様である。図１０との相違点は、前面正面部分２熱交換器の前列側伝熱管と後列側伝熱管の間、また背面部分３熱交換器の前列側伝熱管と後列側伝熱管の間に、これら伝熱管を熱的に遮断する切り込み２０を入れたことにある。この遮断する切り込みの作用について、以下説明する。

【００４９】図１１において、冷房再熱除湿運転時は、実施の形態３と同じく、１５の方向から室内熱交換器に冷媒が流入し、再熱器となる前面上段斜め部分１熱交換器に流入した後分岐され、前面正面部分２熱交換器の後列側伝熱管と、背面部分３熱交換器の後列側伝熱管に流入し、再熱器として動作する。この後冷媒は合流して第２流量制御弁１０に流入して減圧され、蒸発器として作用する前面正面部分２熱交換器の前列側伝熱管と、背面部分３熱交換器の前列側伝熱管に流入して、前面下段部分４熱交換器に流入後、１６より室内熱交換器から冷媒が流出していく。この時温度が高い冷媒が流れる伝熱管１１ａから伝熱フィン２８を熱伝導して、温度が低い冷媒が流れる伝熱管１１ｂに伝わる熱量が存在し、伝熱管１１ａ、１１ｂ間で熱交換してしまい、空気へ熱伝達する熱量が低下する恐れがある。このため本実施例では、伝熱フィン２８に熱伝導を遮断する切り込み２０を入れることにより、伝熱管どうしで熱交換してしまう空調に寄与しない熱量を減らすことができる特徴がある。

【００５０】第３の実施形態における、さらに別の実施例による空気調和機の室内ユニットの断面図を図１２に示す。記号は図１１と同じであり、またこの空気調和機の冷媒回路は図２と同様である。図１１との相違点は、本発明の第２の実施形態に示した補助熱交換器１４を付加したことにある。これにより、図１０や図１１の第３の実施形態における効果に加えて、本発明の第２の実施形態で述べた効果を合わせて発揮することができる。

【００５１】なお、第３の実施形態の図１０、１１、１２においては、室内熱交換器の伝熱管が２列一体の例を示したが、２列以上の多列の場合でも前列側に蒸発器伝熱管、後列側に再熱器伝熱管を配置した冷媒流路とすれば、同様の効果が得られる。また、室内熱交換器を１列

ごとの構造とし、１列熱交換器を２つ以上組み合わせて多列とした熱交換器についても同様の効果が得られる。またこの時各列は熱的に遮断されているので、図１１に示したものと同様の効果が得られる。また、室内熱交換器を円弧状に配置したり、図１０、１１、１２よりさらに多数に分割した多段曲げ構造とし、再熱器と蒸発器の間を熱的に遮断する、例えば伝熱管１１の段間の伝熱フィン２８に切り込みを入れフィンでの熱伝導を防止する等の工夫をしても、本発明の目的は達成される。

【００５２】以上、本発明の第１から３の実施形態による再熱器となる第１室内熱交換器２５の熱交換器容量と蒸発器となる第２室内熱交換器２７の熱交換器容量について述べる。図１では、再熱器となる第１室内熱交換器２５の熱交換器容量と蒸発器となる第２室内熱交換器２７の熱交換器容量が等しい例、すなわち前面下段部分４、前面正面部分２、前面上段斜め部分１、背面部分３、とも２列４段のプレートフィンチューブ熱交換器で構成する例を示したが、図９に、再熱器となる第１室内熱交換器２５の熱交換器容量と蒸発器となる第２室内熱交換器２７の熱交換器容量が異なる例、すなわち前面下段部分４は２列３段、前面正面部分２は２列４段、前面上段斜め部分１は２列５段、背面部分３は２列４段、のプレートフィンチューブ熱交換器で構成する例を示す。室温の低下を防ぎながら除湿を行うためには、室内空気条件、例えば顕熱負荷が小さい場合等には、再熱器となる第１室内熱交換器２５の熱交換器容量を蒸発器となる第２室内熱交換器２７の熱交換器容量以上とし、冷却能力とほぼ等しい加熱能力を確保する必要がある。しかし第２室内熱交換器２７の熱交換器容量が小さすぎると冷却除湿量が小さくなってしまい、冷房再熱除湿運転時における室内での最大潜熱能力制御範囲が狭くなる。このため、室温の低下を防ぎながら除湿を行うための広範囲な潜熱顕熱熱交換能力制御範囲を確保するためには、適切な第１室内熱交換器２５の熱交換器容量と第２室内熱交換器２７の熱交換器容量の比が存在し、室内熱交換器全体容量に対して再熱器となる第１室内熱交換器２５の熱交換器容量を、６０％～６５％とすればよい。この時例えば、室内環境がＪＩＳで定められた標準的冷房空調条件、室内乾球温度２７℃、室内湿球温度１９℃の時、吹出し空気１９の温度が２７℃より低下することなく除湿できる、広範囲な潜熱顕熱熱交換能力制御範囲を確保することができる。

【００５３】以上、本発明の第１から３の実施形態による再熱器となる第１室内熱交換器２５の熱交換器と蒸発器となる第２室内熱交換器２７の熱交換器の伝熱管形状は円管で例えば外径１０ｍｍ以下であるが、円管と断面積が同等である楕円伝熱管や扁平伝熱管であってもその効果は達成される。また、例えば再熱器では伝熱フィン２８に多くの切り起こしを設け空気との伝熱促進を図り、蒸発器では切り起こしの数を少なくして露だれ性を向上させるというように、再熱器となる第１室内熱交換器２５の熱交換器と蒸発器となる第２室内熱交換器２７とで伝熱フィン２８の切り起こし形状やフィンピッチを変えてもよい。また、多段曲げ熱交換器の各部分においても、伝熱フィン２８の切り起こし形状やフィンピッチを変えてもよい。また１列目熱交換器と２列目熱交換器とで伝熱フィン２８の切り起こし形状やフィンピッチを変えてもよい。加えて多段曲げ熱交換器の各部分において、列数を変更してもよい。例えば背面熱交換器３を１列熱交換器として構成してコスト低減を図ってもよい。

【００５４】また以上の本発明の第１から３の実施形態において、冷房再熱除湿運転時に蒸発器となる第２室内熱交換器２７の熱交換器の冷媒流路について説明する。図１には、第２流量制御弁１０を出た後の冷媒が分岐管３０により２分配され、同数の伝熱管１１で構成された背面部分３熱交換器と前面下部４熱交換器に流れる例を示しており、管内の冷媒流動抵抗が同一となり冷媒流量の不均一さが生じず、均一な熱交換量を確保でき蒸発器としての性能を十分に発揮することができる。また、分岐管３０が２分岐以上でも伝熱管本数を揃える等の方法により、管内冷媒流動抵抗が同一となるようにしてやればよい。一方、図６には、第２流量制御弁１０を出た後の冷媒が分岐管３０により２分配され、異なる本数の伝熱管１１で構成された背面部分３熱交換器と前面下部４熱交換器に流れる例を示す。この時冷媒流路長さが異なるため、各流路の管内冷媒流動抵抗が厳密には異なり冷媒流量の不均一さが生じる可能性があるが、冷房再熱除湿運転時の冷媒流量は、各流路の管内冷媒流動抵抗に差が生じるほど多くないため、冷媒流量の不均一さは現実には生じない。また吸込空気流れ９に分布がある場合は、空気側の熱負荷により冷媒流量バランスが決定されるので、冷媒流路長さが冷媒流量バランスに影響を与えることはない。なお、第２流量制御弁１０を出た後の分岐管３０入口は気液二相流となるため、分岐管３０で不均一分配を起こしやすい。従ってこの分岐管での冷媒流れ方向を垂直方向、好ましくは垂直上昇方向にするなどの工夫により、気液二相冷媒の均一分配を実現する必要があり、このような対策をとることにより、均一な熱交換量を確保でき蒸発器としての性能を十分に発揮することが可能となる。

【００５５】実施の形態４．本発明の第４の実施形態による空気調和機について説明する。室内ユニットの構造は例えば図１であり、冷媒回路は図２で、冷媒として例えばＲ４１０Ａを用いている。この時室内ユニット１８に配置される第２流量制御弁１０に、図１３に示した構造の流量制御弁を用いたことを特徴とする。以下、この流量制御弁の構造、動作について説明する。

【００５６】図１３において、第２流量制御弁１０におけける３１が第１流路で第１室内熱交換器２５に接続され、３２が第２流路で第２室内熱交換器２７に接続され

ている。３３は冷媒流路が開口する主弁座、３４は第２流量制御弁１０本体の内面に沿って上下に摺動する主弁体で、これら主弁座３３と主弁体３４で絞り部を構成している。３５は主弁体３４を駆動する電磁コイルで、制御部（図示無し）からの指令に基づいて、電磁コイル３５を通電遮電し、主弁体３４を開閉する。主弁体３４は冷媒流れ方向に連通する多孔質透過材により形成され、具体的には金属粉やセラミック粉、発砲金属および発砲樹脂などを型に入れて加圧成形し、溶融点以下の温度で焼き固めた物で構成されている。電磁コイル３５に通電すると、主弁体３４は上昇し、主弁座３３から離れ、第１流路３１と第２流路３２が流動抵抗なく冷媒が流動する。また再び電磁コイル３５に通電すると、主弁体３４は下降し、主弁座３３と密着し、主弁体３４を構成する多孔質透過材を介して、第１流路３１と第２流路３２が連通する。

【００５７】次に、本実施例に示した流量制御弁を用いた空気調和機の動作について説明する。通常冷房運転時は図２の実線の矢印に示す方向に、通常暖房運転時は図２の点線の矢印に示す方向に、冷媒が流れる。この時、第１流量制御弁２４により、冷凍サイクルの流量が調整され、第２流量制御弁１０は図１３（ａ）に示すように、主弁体３４は上昇して主弁座３３から離れ、第１流路３１と第２流路３２が連通し、流動抵抗なく冷媒が流動する。従って、冷媒圧力損失増加による能力の低下や効率の低下がなく、空気調和機を動作させることができる。

【００５８】一方冷房再熱除湿運転時は、本発明における第１の実施の形態と同じく、第１流量制御弁２４の開度を開き気味とし、第２流量制御弁１０を主たる減圧装置として使用する冷凍サイクルとなる。この冷房再熱除湿運転時の冷凍サイクルにおける、圧力－エンタルピ線図も本発明における第１の実施の形態と同じく図３となる。すなわち、第２流量制御弁１０は図１３（ｂ）に示すように、主弁体３４が下降して主弁座３３と密着し、主弁体３４を構成する多孔質透過材を介して第１流路３１と第２流路３２が連通し、多孔質透過材が流動抵抗体として作用する。

【００５９】このとき、第２流量制御弁１０の流動抵抗体として多孔質透過材を用いているので、第２流量制御弁１０を気液二相冷媒もしくは液冷媒が通過する際の冷媒流動音を大幅に低減することができる。例えば図２５に示す特開平１０－８９８０３に用いられている従来の第２流量制御弁１０は、図２６に示すように主弁座３３と主弁体３４の隙間のオリフィスを流動抵抗体として作用させているので、気液二相流が通過する際に非常に大きな冷媒流動音が発生する。特に図３に示すように、第２流量制御弁１０の入口がＤ点のように冷媒乾き度が小さく気液二相冷媒の流動様式がスラグ流となる場合に、大きな冷媒流動音になることが知られている。この冷媒流動音の発生原因としては、流れ方向に対して蒸気冷媒が断続的に流れ、オリフィス部をそのオリフィス径より大きな蒸気スラグもしくは蒸気気泡が通過する際に、蒸気スラグもしくは蒸気気泡が崩壊することにより振動が発生し、図２６における主弁座３３等を伝搬して音が発生したり、オリフィス部を速度が異なる蒸気冷媒と液冷媒が交互に通過するため、それに伴って圧力変動が生じ、主弁座３３等を伝搬して音が発生するためである。

【００６０】これに対して、図１３（ｂ）に示した本実施例における第２流量制御弁１０では、気液二相冷媒や液冷媒は多孔質透過材で構成されている主弁体３４の微細で無数の通気孔を通過し減圧される。そのため、蒸気スラグや蒸気泡が崩壊することは無い。また、蒸気冷媒と液冷媒が同時に絞り部を通過するため非常によく混合し冷媒の速度変動が生じず、圧力も変動しない。図２６に示した従来の第２流量制御弁１０では流路が１ヶ所であるが、多孔質透過材では内部の流路が複雑に構成され、この小孔が流動抵抗体となり、この内部で圧力が低下する。多孔質透過材はその内部において流速変動は圧力変動として繰り返され一部熱エネルギに変換しながら圧力変動を一定にする効果がある。これを一般に吸音効果と言い、音を消すメカニズムと考えられる。また、多孔質透過材内部で冷媒の流速が十分に減速され、一定となるため、多孔質透過材出口部で流れに渦が発生することも無く噴流騒音も小さくなる効果がある。このため第２流量制御弁１０から発生する冷媒流動音を大幅に低減することができる。上述した実施の形態１～３の構成では、蒸発器が背面部分３と前面下段部分４とに配置されるため、従来のような第２流量制御弁を用いると絞り部を通過した冷媒の吹出し音が背面部分３と前面下段部分４とに伝播し、延いては空気調和機室内ユニット１８の前面側吸込口（９ａ、９ｂ、９ｄの吸込口）と上面側吸込口（９ａの一部と９ｃの吸込口）の両方から騒音を発生する。一般に用いられる壁掛け式空気調和機では特に上面側吸込口からの騒音が直上の天井面で反射され、室内へ伝わり易く、さらには前面側吸込口からの騒音と共鳴するなどの心配もある。本実施の形態のように第２流量制御弁に多孔質透過材の弁を用いれば、吹出し騒音を低減できるので、第２流量制御弁を原因とする蒸発器からの騒音の発生を低減できる。

【００６１】また本実施例では冷媒としてＲ４１０Ａを用いる例を示したが、従来冷媒Ｒ２２と比較してＲ４１０Ａは動作圧力が高くなる（図３に示す点Ｄ、Ｅの高さ）ため、第２流量制御弁１０での流動抵抗を従来冷媒Ｒ２２より大きくし、第２流量制御弁１０での減圧量を従来冷媒Ｒ２２より大きくする必要がある。このため、例えば図２５に示す特開平１０－８９８０３に用いられている従来の第２流量制御弁１０では、主弁座３３と主弁体３４の隙間のオリフィスをさらに小さくして流動

抵抗を大きくする必要があり、Ｒ４１０Ａを用いた場合従来冷媒Ｒ２２より必然的に気液二相流が通過する際に非常に大きな冷媒流動音が発生してしまう。従って、本実施例に示した多孔質透過材を用いた第２流量制御弁１０をＲ４１０Ａ冷媒空気調和機に適用することにより、冷媒流動音を大幅に低減する効果をより一層発揮することができる。なお、本実施例に示した多孔質透過材を用いた第２流量制御弁１０を従来冷媒Ｒ２２空気調和機に適用したとしても、その効果は十分発揮される。加えて、従来冷媒Ｒ２２と比較して動作圧力が高いが、地球温暖化係数がＲ２２やＲ４１０Ａより小さく地球環境に優しいＲ３２冷媒を本実施例に示した空気調和機に適用したとしても、その効果は十分発揮される。また、地球温暖化係数がＲ２２やＲ４１０Ａより極端に小さく地球環境に優しいＲ２９０冷媒を本実施例に示した空気調和機に適用したとしても、その効果は十分得られる。また冷媒としては、ＨＦＣ系（Ｒ１１６、Ｒ１２５、Ｒ１３４ａ、Ｒ１４、Ｒ１４３ａ、Ｒ１５２ａ、Ｒ２２７ｅａ、Ｒ２３、Ｒ２３６ｅａ、Ｒ２３６ｆａ、Ｒ２４５ｃａ、Ｒ２４５ｆａ、Ｒ３２、Ｒ４１、ＲＣ３１８などや、これら冷媒の数種の混合冷媒Ｒ４０７Ａ、Ｒ４０７Ｂ、Ｒ４０７Ｃ、Ｒ４０７Ｄ、Ｒ４０７Ｅ、Ｒ４１０Ｂ、Ｒ４０４Ａ、Ｒ５０７Ａ、Ｒ５０８Ａ、Ｒ５０８Ｂなど）、ＨＣ系（ブタン、イソブタン、エタン、プロパン、プロピレンなどや、これら冷媒の数種の混合冷媒）、自然冷媒（空気、炭酸ガス、アンモニアなどや、これら冷媒の数種の混合冷媒）、またこれらＨＣＦＣ系やＨＦＣ系、ＨＣ系、自然冷媒などの数種の混合冷媒など、どんな冷媒を用いてもその効果は発揮される。

【００６２】なお、冷房再熱除湿運転時の第２流量制御弁１０の流量特性（冷媒流量と冷媒圧力損失の関係）は、主弁体３４に用いる多孔質透過材の大きさや冷媒が通過する流路長さおよび多孔質透過材の空隙率（単位体積あたりの隙間容積）を調整することによって、調整することができる。すなわちある冷媒流量を小さな圧力損失で流す場合は、多孔質透過材の孔径を大きくしたり（例えば、多孔質透過材の素子を大きくするなど）、流路長さを短くしたり（弁本体を短くするなど）、空隙率が大きい多孔質透過材を用いれば良い。また、逆にある冷媒流量を大きな圧力損失で流す場合は多孔質透過材の孔径を小さくしたり（例えば、多孔質透過材の素子を小さくするなど）、流路長さを長くしたり（弁本体を長くするなど）、空隙率が小さい多孔質透過材を用いれば良い。このような主弁体３４に用いる多孔質透過材の孔径や弁本体の形状は、空気調和機設計時に最適に設計される。

【００６３】これにより、従来空気調和機で必要であった、第２流量制御弁１０の回りに遮音材や制振材を周囲に巻きつけるなどの対策も不要でコスト低減となり、さらにこれら他材質が不要となるため、空気調和機のリサイクル性も向上する。

【００６４】なお、以上冷房再熱除湿運転時の動作について述べたが、冷媒流れ方向が逆となる暖房除湿運転時（図４に示した冷凍サイクル運転状態）においても、同様の効果が得られる。

【００６５】また、上述した多孔質透過材を用いた流量制御弁は、第１流量制御弁２４に用いても、冷媒流動音を低減するなどの同様の効果が得られる。また上述した気液二相冷媒に起因する冷媒流動音の発生に対しては、空気調和機に限定されることなく、冷蔵庫などを含めた冷熱空調機器の冷凍サイクル一般についての課題であり、本実施の形態に示した流量制御弁は、このような冷凍サイクル一般に広く適用することで、冷媒流動音を低減するなどの同様の効果が得られる。

【００６６】実施の形態５．本発明の第５の実施形態による空気調和機について説明する。図１５は、本発明の冷媒回路で、図２と同一の部位には、同一の番号を付けている。室内ユニット１８の構造は例えば図１であり、冷媒として例えばＲ４１０Ａを用いている。この時室内ユニット１８に配置される第１室内熱交換器２５と第２室内熱交換器２７の間の配管に、多孔質透過材を用いた絞り装置３６を設け、これと並列に絞り装置３６をバイパスする冷媒流路上に電磁開閉弁３７を設けている。この絞り装置３６の構造の一例を図１４に示す。絞り装置３６本体は円筒状の容器で構成され、多孔質透過材の一例である焼結金属３８がオリィフィス３９を挟み込む構造としている。多孔質透過材の他の例としては実施の形態4にも述べたように、金属粉やセラミック粉、発砲金属および発砲樹脂などを型に入れて加圧成形し、溶融点以下の温度で焼き固めた物であればよい。そして焼結金属３８の両端は、バネ４０と突起４１で固定されている。以下、この絞り装置３６と電磁開閉弁３７の動作について説明する。

【００６７】この実施の形態において、通常冷房運転時と通常暖房運転時は、電磁開閉弁３７を開状態とし、冷媒流路を構成する。この時、絞り装置３６の流動抵抗に対して電磁開閉弁３７の流動抵抗が小さいので、冷媒は絞り装置３６をバイパスして電磁開閉弁３７を流れる。従って、冷媒圧力損失増加による能力の低下や効率の低下がなく、空気調和機を動作させることができる。一方、冷房再熱除湿運転時の冷凍サイクル運転状態は図３と同様であり、電磁開閉弁３７を閉状態とし、冷媒は絞り装置３６を通って減圧される。この時、図１４における実線の矢印方向に流入した気液二相冷媒は焼結金属３８を通過する。この時、焼結金属３８は実施の形態4における図１３（ｂ）の主弁体３４に用いた多孔質透過材と同様の作用を示し、冷媒流動音の発生を防止することができる。

【００６８】なお、図１４においては、焼結金属３８がオリィフィス３９を挟み込む構造としたが、オリィフィ

ス３９は、焼結金属３８のみでは流動抵抗が小さく、所定の減圧作用が得られ場合に併用すればよい物であり、多孔質透過材の大きさや冷媒が通過する流路長さおよび多孔質透過材の空隙率（単位体積あたりの隙間容積）を調整することによって、流動抵抗を調整することができれば、焼結金属３８単独で流動抵抗として用いても良い。また、オリィフィス３９を併用する場合、焼結金属３８はオリィフィス３９の冷媒流れ上流側３８ａ、もしくは冷媒流れ下流側３８ｂのみの配置としても、通過する気液二相流は非常によく混合されるので、冷媒流動音の発生を防止することができる。なお、暖房除湿運転時は、図１４における点線の矢印方向に冷媒が流入するが、この時も冷房再熱除湿時と同様の冷媒流動音低減効果を得ることができる。また、絞り装置３６は、焼結金属３８がオリィフィス３９を挟み込む簡単な構造としており、実施の形態４における図１３のように主弁体３４に用いた多孔質透過材を用いた流量制御弁より非常に安価となり、加えて電磁開閉弁３７は従来から用いられている二方弁を流用できるので、絞り装置３６と電磁開閉弁３７を併用しても、実施の形態４における図１３の流量制御弁１０より、安価にすることができる。

【００６９】以上に述べた効果は、Ｒ４１０Ａ冷媒を用いた場合、特にその効果を発揮するが、従来冷媒Ｒ２２や、ＨＦＣ系（Ｒ１１６、Ｒ１２５、Ｒ１３４ａ、Ｒ１４、Ｒ１４３ａ、Ｒ１５２ａ、Ｒ２２７ｅａ、Ｒ２３、Ｒ２３６ｅａ、Ｒ２３６ｆａ、Ｒ２４５ｃａ、Ｒ２４５ｆａ、Ｒ３２、Ｒ４１、ＲＣ３１８などや、これら冷媒の数種の混合冷媒Ｒ４０７Ａ、Ｒ４０７Ｂ、Ｒ４０７Ｃ、Ｒ４０７Ｄ、Ｒ４０７Ｅ、Ｒ４１０Ｂ、Ｒ４０４Ａ、Ｒ５０７Ａ、Ｒ５０８Ａ、Ｒ５０８Ｂなど）、ＨＣ系（ブタン、イソブタン、エタン、プロパン、プロピレンなどや、これら冷媒の数種の混合冷媒）、自然冷媒（空気、炭酸ガス、アンモニアなどや、これら冷媒の数種の混合冷媒）、またこれらＨＣＦＣ系やＨＦＣ系、ＨＣ系、自然冷媒などの数種の混合冷媒など、どんな冷媒を用いてもその効果は発揮される。

【００７０】本発明の第５の実施形態における絞り装置３６の他の構造例を、図１６、図１７に示す。図１６における焼結金属３８は、内部の一端が閉じられ、多端が開放された円筒状形状を形成し、オリィフィス３９とバネ４０と突起４１で固定されている。またオリィフィス３９は円周部が部分的に切り欠れた円盤状となっており、矢印の方向から流入した冷媒が円筒状の焼結金属３８内部に流入して減圧され、一部は円筒状外面の周囲からしみ出しオリィフィス３９の円周部の切り欠きから、一部は円筒状外面の底面からしみ出しオリィフィス３９の中心から、流出して減圧される構造である。

【００７１】一方図１７は、図１６と同様な形状の焼結金属３８が、オリィフィス３９とバネ４０と突起４１で固定されている。矢印の方向から流入した冷媒が、一部はオリィフィス３９の円周部の切り欠きから、一部はオリィフィス３９の中心から流入して減圧され、焼結金属３８の円筒状底面または円筒状外面の周囲から流入して減圧される構造である。図１６、図１７のいずれの場合においても、絞り装置３６では、絞り部を焼結金属３８で構成していることにより、冷媒流動音を大幅に低減することができる。

【００７２】なお、実施の形態４、５においては、多孔質透過材は円盤または円筒形状の例について説明したが、これに限ることなく直方体など、どのような形状で構成してもよく、冷媒が多孔質透過材を通過する際、所定の減圧作用が得られればよい。

【００７３】実施の形態６．本発明の第６の実施形態による空気調和機について説明する。図１８は、本発明の冷媒回路で、冷媒はＲ４１０Ａを用いており、図２と同一の部位には、同一の番号を付けている。室内ユニットの構造は例えば図１である。この時室外ユニットに配置される室外熱交換器２３と第１流量制御弁２４をバイパスする冷媒回路５１を設け、この冷媒回路上に流量制御弁５２を設けている。以下、このバイパスする冷媒回路５１と流量制御弁５２の動作について説明する。

【００７４】この実施の形態において、通常冷房運転時と通常暖房運転時は、流量制御弁５２を閉状態として、通常の冷媒流路を構成する。また冷房再熱除湿運転時に、流量制御弁５２を閉状態とした時の冷凍サイクル運転状態は図３と同様である。一方、冷房再熱除湿運転時に流量制御弁５２を開状態とした時の冷凍サイクル運転状態を図１９に示す。この時、冷媒は室外熱交換器２３を流れずに流動抵抗がほとんど無い冷媒回路５１を流れるので、室外熱交換器２３で凝縮せずに、過熱ガス状態で再熱器となる第１室内熱交換器２５（Ｃ点）に流入し、凝縮熱は全て室内空気を加熱する。この後、第２流量制御弁に流入（Ｄ点）して減圧され（Ｅ点）、第２室内熱交換器２７にて蒸発し、室内空気を冷却除湿する。従って、流量制御弁５２を閉状態としたときよりも、より多くの再熱熱交換量を得ることができ、室温の低下を防ぎながら除湿を行う再熱除湿運転の能力制御範囲を拡大することができる。また、暖房再熱運転除湿時にも、流量制御弁５２を開状態とすることにより冷媒は冷媒回路５１を流れるので、室外熱交換器２３で冷媒は蒸発せずに、第１室内熱交換器２５にて全て蒸発し、流量制御弁５２を閉状態としたときよりも、より多くの蒸発熱交換量を得ることができるので、除湿量を増加させることができ、再熱除湿運転の能力制御範囲を拡大することができる。従来図２５のもの等では、蒸発器を通過した空気と再熱器を通過した空気との混合があまりよくなく、いたずらに再熱除湿能力を上げても露発生の原因となったりしていたが、実施の形態１～３に示すような空気の混合状態のよいものとすれば、このような顕熱能力の増大を図って、再熱除湿能力を向上させることが可能にな

る。なお、以上に述べた効果は、Ｒ４１０Ａ冷媒を用いた場合のみならず、従来冷媒Ｒ２２や、ＨＦＣ系（Ｒ１１６、Ｒ１２５、Ｒ１３４ａ、Ｒ１４、Ｒ１４３ａ、Ｒ１５２ａ、Ｒ２２７ｅａ、Ｒ２３、Ｒ２３６ｅａ、Ｒ２３６ｆａ、Ｒ２４５ｃａ、Ｒ２４５ｆａ、Ｒ３２、Ｒ４１、ＲＣ３１８などや、これら冷媒の数種の混合冷媒Ｒ４０７Ａ、Ｒ４０７Ｂ、Ｒ４０７Ｃ、Ｒ４０７Ｄ、Ｒ４０７Ｅ、Ｒ４１０Ｂ、Ｒ４０４Ａ、Ｒ５０７Ａ、Ｒ５０８Ａ、Ｒ５０８Ｂなど）、ＨＣ系（ブタン、イソブタン、エタン、プロパン、プロピレンなどや、これら冷媒の数種の混合冷媒）、自然冷媒（空気、炭酸ガス、アンモニアなどや、これら冷媒の数種の混合冷媒）、またこれらＨＣＦＣ系やＨＦＣ系、ＨＣ系、自然冷媒などの数種の混合冷媒など、どんな冷媒を用いてもその効果は発揮される。

【００７５】実施の形態７．本発明の第７の実施形態による空気調和機について説明する。図２０は、本発明の冷媒回路で、冷媒はＲ４１０Ａを用いており、図２と同一の部位には、同一の番号を付けている。室内ユニット１８の構造は例えば図１である。この時第１室内熱交換器２５と第２流量制御弁１０の間の配管と、第２室内熱交換器２７と四方弁２２の間の配管とを熱交換する熱交換器５３を設け、第２流量制御弁１０をバイパスする冷媒回路に電磁開閉弁５４を設けている。以下、この熱交換器５３と電磁開閉弁５４の動作について説明する。

【００７６】この実施の形態において、通常冷房運転時と通常暖房運転時は、流量制御弁５４を開状態として、通常の冷媒流路を構成する。冷房再熱除湿運転時に、流量制御弁５４を閉状態とした上で、第１流量制御弁２４の開度を開き気味とし、第２流量制御弁１０を主たる減圧装置として使用する冷凍サイクルとなる。この冷房再熱除湿運転時の冷凍サイクルにおける、圧力－エンタルピ線図を図２１に示す。図２１中のＡ～Ｈは、図２０中の冷媒回路におけるＡ～Ｈにそれぞれ対応し、冷房再熱除湿運転時の冷媒流れ方向を図２０中の実線の矢印で示す。圧縮機２１から吐出され、四方弁２２を通った冷媒は、Ａ点から室外熱交換器２３にて凝縮しＢ点となり、第１流量制御弁２４で若干減圧されＣ点となり、第１室内熱交換器２５に流入する。この時第１室内熱交換器２５は再熱器として作用し、Ｄ点まで再凝縮する。この後Ｄ点を出た冷媒は、第２室内熱交換器２７の出口配管を流れる低温低圧冷媒と熱交換器５３で熱交換して冷却され過冷却液となり、Ｅ点となる。この後第２流量制御弁１０を通ってＦ点まで減圧され、第２室内熱交換器２７に流入する。この時第２室内熱交換器２７は蒸発器として作用し、Ｇ点まで蒸発して、第１室内熱交換器２５の出口配管を流れる高温高圧冷媒と熱交換器５３で熱交換して加熱されＨ点となり、圧縮機２１の吸入に戻る冷凍サイクルとなる。

【００７７】従って、図２１に示すように第２流量制御弁１０入口冷媒が液状態となるため、第２流量制御弁１０に気液二相状態の冷媒が流入する装置と比較して、冷媒が通過する際の冷媒流動音を大幅に低減することができる。また、上述した実施の形態１～３の構成では、蒸発器が背面部分３と前面下段部分４とに配置されるため、従来のような第２流量制御弁を用いると絞り部を通過した冷媒の吹出し音が背面部分３と前面下段部分４とに伝播し、延いては空気調和機室内ユニット１８の前面側吸込口（９ａ、９ｂ、９ｄの吸込口）と上面側吸込口（９ａの一部と９ｃの吸込口）の両方から騒音を発生する。一般に用いられる壁掛け式空気調和機では特に上面側吸込口からの騒音が直上の天井面で反射され、室内へ伝わり易く、さらには前面側吸込口からの騒音と共鳴するなどの心配もある。本実施の形態のように熱交換器５３を設け、第２流量制御弁の入口冷媒を液状態とすれば、第２流量制御弁からの吹出し騒音を低減できるので、第２流量制御弁を原因とする蒸発器からの騒音の発生を低減できる。なお、本実施の形態においては、Ｄ点からＥ点の配管をＧ点からＨ点の配管と接触させて熱交換する例を示したが、これに限ることなく、Ｄ点からＥ点の配管を室内吹出し空気にて冷却するように室内ユニット１８を構成しても、同様の効果が得られる。

【００７８】なお、以上述べた効果はどんな冷媒でも発揮されるが、特に液比熱が大きいＲ４１０ＡやＲ３２やＲ２９０冷媒を用いた場合には、過冷却度が大きい方が冷凍サイクルの効率がより向上するため、その効果をより一層発揮することができる。また冷媒としてＨＣＦＣ系（Ｒ２２やＲ１２３などや、これら冷媒の数種の混合冷媒）やＨＦＣ系（Ｒ１１６、Ｒ１２５、Ｒ１３４ａ、Ｒ１４、Ｒ１４３ａ、Ｒ１５２ａ、Ｒ２２７ｅａ、Ｒ２３、Ｒ２３６ｅａ、Ｒ２３６ｆａ、Ｒ２４５ｃａ、Ｒ２４５ｆａ、Ｒ３２、Ｒ４１、ＲＣ３１８などや、これら冷媒の数種の混合冷媒Ｒ４０７Ａ、Ｒ４０７Ｂ、Ｒ４０７Ｃ、Ｒ４０７Ｄ、Ｒ４０７Ｅ、Ｒ４１０Ｂ、Ｒ４０４Ａ、Ｒ５０７Ａ、Ｒ５０８Ａ、Ｒ５０８Ｂなど）、ＨＣ系（ブタン、イソブタン、エタン、プロパン、プロピレンなどや、これら冷媒の数種の混合冷媒）、自然冷媒（空気、炭酸ガス、アンモニアなどや、これら冷媒の数種の混合冷媒）、またこれらＨＣＦＣ系やＨＦＣ系、ＨＣ系、自然冷媒などの数種の混合冷媒などを用いてもその効果は発揮される。

【００７９】実施の形態８．本発明の第８の実施形態による空気調和機について説明する。図２２は、本発明の冷媒回路で、冷媒はＲ４１０Ａを用いており、図２と同一の部位には、同一の番号を付けている。室内ユニット１８の構造は例えば図１である。この時第１室内熱交換器２５と第１流量制御弁２４の間の配管に、例えば高圧レシーバのような液冷媒を貯留する容器５５を設けている。以下、この容器５５の動作について説明する。

【００８０】この実施の形態において、この容器５５に

は、通常暖房運転時や暖房除湿運転時に発生する余剰冷媒を貯留し、これら運転時の冷媒過多による効率低下を防ぐ働きをする。すなわち冷房再熱除湿運転時には、室外熱交換器２３と第１室内熱交換器２５が凝縮器として動作し、熱交換の内容積が大きくなるため、必要となる冷媒量が増大する。従ってこの空気調和機の充填冷媒量は、冷房再熱除湿運転時に冷媒不足とならないようにするための冷媒量となる。一方通常暖房運転時は、第２室内熱交換器２７と第１室内熱交換器２５が凝縮器となり、暖房除湿運転時には第２室内熱交換器２７のみが凝縮器となるため、凝縮器となる熱交換の内容積が冷媒時と比較して少なく、これら運転時の必要冷媒量は冷房時より少なくなる。従って冷房再熱除湿運転基準の冷媒充填量にて、容器５５を設けずに暖房運転または暖房除湿運転を行うと、冷媒過多の運転となり、効率の低下や圧縮機２１への液バック量増大による信頼性の低下などの問題点が生じる。

【００８１】従ってこの実施の形態において、容器５５を設けることにより、通常暖房運転時や暖房除湿運転時に発生する余剰冷媒を貯留して、全ての運転モードにおける循環冷媒量を最適に制御することにより、これら運転時の圧縮機２１信頼性向上および効率向上を達成することができる。なお、容器５５の内容積は、あらかじめ各運転モードにおける最適冷媒量を試験や計算によって求め、その最大冷媒量と最小冷媒量の差が貯留できる内容積として決定すればよい。また図２２にはこの容器５５を室外ユニット１７内に設置する例を示したが、室内ユニット１８内に設けても、その効果は発揮される。なお、以上述べた効果は、冷媒として従来冷媒Ｒ２２やＨＦＣ系（Ｒ１１６、Ｒ１２５、Ｒ１３４ａ、Ｒ１４、Ｒ１４３ａ、Ｒ１５２ａ、Ｒ２２７ｅａ、Ｒ２３、Ｒ２３６ｅａ、Ｒ２３６ｆａ、Ｒ２４５ｃａ、Ｒ２４５ｆａ、Ｒ３２、Ｒ４１、ＲＣ３１８などや、これら冷媒の数種の混合冷媒Ｒ４０７Ａ、Ｒ４０７Ｂ、Ｒ４０７Ｃ、Ｒ４０７Ｄ、Ｒ４０７Ｅ、Ｒ４１０Ｂ、Ｒ４０４Ａ、Ｒ５０７Ａ、Ｒ５０８Ａ、Ｒ５０８Ｂなど）、ＨＣ系（ブタン、イソブタン、エタン、プロパン、プロピレンなどや、これら冷媒の数種の混合冷媒）、自然冷媒（空気、炭酸ガス、アンモニアなどや、これら冷媒の数種の混合冷媒）、またこれらＨＣＦＣ系やＨＦＣ系、ＨＣ系、自然冷媒などの数種の混合冷媒など、どんな冷媒でもその効果を発揮することができる。

【００８２】実施の形態９．本発明の第９の実施形態による空気調和機について説明する。図２３は、本発明の冷媒回路および運転制御に用いる各種センサ・アクチュエータ制御機器の構成図で、冷媒はＲ４１０Ａを用いており、図２と同一の部位には、同一の番号を付けている。室内ユニット１８の構造は例えば図１である。以下、この実施形態における空気調和機の運転制御法について説明する。空気調和機には、室内の居住者が好みの温湿度環境を設定するための設定装置７５が備えられている。この設定装置７５では、例えば温度と湿度両方を設定するが、この設定温湿度は居住者がそれぞれの設定値を室内ユニット１８に付属するリモコンから直接入力してもよい。また室内ユニット１８には、室内の温度および湿度を検知するために、室内ユニット１８の吸い込み空気温度センサー６５および湿度センサー６６がそれぞれ設けられている。

【００８３】空気調和機運転時には、設定温湿度と現在の室内吸込み空気温湿度との差を温湿度偏差として演算し、これら偏差より、第１の演算装置６７にて室内の空調負荷である潜熱および顕熱負荷を推算する。そしてこれら偏差がゼロ、あるいは所定の値以内となるように、信号線７３を通じて空気調和機の各アクチュエータ、圧縮機２１回転数、室外ファン６１回転数、室内ファン６３回転数、第１流量制御弁２４の絞り開度、および第２流量制御弁１０の絞り開度に制御信号を伝達して、これらアクチュエータを制御してやることにより潜熱および顕熱能力を調整して空調能力を発揮する。通常冷房運転時や通常暖房運転時におけるこれらアクチュエータの制御方法は、第２流量制御弁１０を全開として動作させない従来の空気調和機と同様であるが、冷房再熱除湿運転時の冷凍サイクルは図３に示した圧力－エンタルピ線図と同様となり、再熱器となる第１室内熱交換器能力と蒸発器となる第２室内熱交換器の能力を調整し、潜熱および顕熱負荷を制御して空調能力を発揮する。潜熱能力の増減は、蒸発器となる第２室内熱交換器の能力の増減により調整を行う。一方蒸発器能力の増加により顕熱能力も増加するので、顕熱負荷以上の顕熱能力が発揮されてしまう場合は、再熱器となる第１室内熱交換器の能力を増加させる方に調整して加熱し、顕熱能力を調整する。この時の各アクチュエータの制御方法について、以下説明する。

【００８４】例えば第１の例として、空気調和機運転時に温湿度偏差から第１の演算装置６７にて推算された室内の潜熱顕熱負荷の情報が室内ユニット１８内の信号線７３ａを経由して、第２の演算装置７４に伝達されて室内ファン６３の室内ファンモータ６４の回転数変化量が演算される。すなわち現状の室内ファン６３回転数の情報が、室内ファンモータ６４回転数制御装置６９より信号線７３ａを経由して第２の演算装置７４に伝達されており、室内の潜熱顕熱負荷が大きいほど、室内ファンモータ６４回転数を現状より大きい値として演算し、新たな室内ファンモータ６４回転数の情報が信号線７３ａを経由して室内ファンモータ回転数制御装置６９に伝達され、新たな室内ファンモータ６４回転数として制御される。こうして室内ファン６３の送風量増加により潜熱顕熱能力が増加する。

【００８５】また例えば第２の例として、空気調和機運転時に温湿度偏差から第１の演算装置６７にて推算され

た室内の潜熱顕熱負荷の情報が信号線７３ａを経由して、第２の演算装置７４に伝達されて室外ファン６１の室外ファンモータ６２の回転数変化量が演算される。すなわち現状の室外ファン６２回転数の情報が、室外ファンモータ６２回転数制御装置６８より室外ユニット１７内の信号線７３ｃ、および室外ユニット１７と室内ユニット１８を結ぶ信号線７３ｂを経由して第２の演算装置７４に伝達されており、室内での再熱熱交換量を大きくしたい時ほど、室外ファンモータ６２回転数を現状より小さい値として演算し、新たな室外ファンモータ６２回転数の情報が信号線７３ｂ、７３ｃを経由して室外ファンモータ回転数制御装置６８に伝達され、新たな室外ファンモータ６２回転数として制御される。この時室外ファン６１の送風量低下により室外での凝縮能力が低下して、相対的に第１室内熱交換器２５での凝縮能力が増加し室内での再熱熱交換量が増加して、顕熱熱交換量を制御することができる。

【００８６】また例えば第３の例として、空気調和機運転時に温湿度偏差から第１の演算装置６７にて推算された室内の潜熱顕熱負荷の情報が信号線７３ａを経由して、第２の演算装置７４に伝達されて圧縮機２１回転数の変化量が演算される。すなわち現状の圧縮機２１回転数の情報が、圧縮機回転数制御装置７０より信号線７３ｃ、７３ｂを経由して第２の演算装置７４に伝達されており、室内の潜熱顕熱熱交換量を大きくしたい時ほど、圧縮機２１回転数を現状より大きい値として演算し、新たな圧縮機２１回転数の情報が信号線７３ｂ、７３ｃを経由して圧縮機回転数制御装置７０に伝達され、新たな圧縮機２１回転数として制御される。この時図３に示す圧力－エンタルピ線図における冷凍サイクルでは、冷媒流量の増加により室内での潜熱顕熱熱交換量が増加する。

【００８７】また例えば第４の例として、空気調和機運転時に温湿度偏差から第１の演算装置６７にて推算された室内の潜熱顕熱負荷の情報が信号線７３ａを経由して、第２の演算装置７４に伝達されて第１流量制御弁２４の弁開度変化量が演算される。すなわち現状の第１流量制御弁２４の弁開度情報が、第１流量制御弁２４弁開度制御装置７１より信号線７３ｃ、７３ｂを経由して第２の演算装置７４に伝達されており、室内での顕熱熱交換量を大きくしたい時ほど、第１流量制御弁２４の弁開度を現状より小さい値として演算し、新たな第１流量制御弁２４の弁開度の情報が信号線７３ｂ、７３ｃを経由して第１流量制御弁２４の弁開度制御装置７１に伝達され、新たな第１流量制御弁２４の弁開度として制御される。この時第１流量制御弁２４の弁開度の低下により、図３に示した点Ｃ、点Ｄ間の圧力が低下して第１室内熱交換器２５での凝縮温度が低下し再熱熱交換量が低下して、室内での顕熱熱交換量を調整する。

【００８８】また例えば第５の例として、空気調和機運転時に温湿度偏差から第１の演算装置６７にて推算された室内の潜熱顕熱負荷の情報が信号線７３ａを経由して、第２の演算装置７４に伝達されて第２流量制御弁１０の弁開度変化量が演算される。すなわち現状の第２流量制御弁１０の弁開度情報が、第２流量制御弁１０弁開度制御装置７２より信号線７３ａを経由して第２の演算装置７４に伝達されており、室内での潜熱顕熱熱交換量を大きくしたい時ほど、第２流量制御弁１０の弁開度を現状より小さい値として演算し、新たな第２流量制御弁１０の弁開度の情報が信号線７３ａを経由して第２流量制御弁１０弁開度制御装置７２に伝達され、新たな第２流量制御弁１０の弁開度として制御される。この時第２流量制御弁１０の弁開度の低下により、図３に示した点Ｅ、点Ｆ間の圧力が低下して第２室内熱交換器２７での蒸発温度が低下して、室内での潜熱顕熱熱交換量を調整する。

【００８９】なお、前述第１から第５の例として、５種類のアクチュエータ各々の制御方法について述べたが、これらアクチュエータは各種情報を基に個別に制御しても、５種類中の特定のアクチュエータを組み合わせて制御しても、５種類中の特定のアクチュエータ情報を基に別のアクチュエータを制御しても、それぞれのアクチュエータに優先度をつけて制御してもよい。例えば、室内ファン６３送風量が小さい状態で圧縮機２１の回転数を増加させると、潜熱顕熱熱交換量は増加するが蒸発温度が低下しすぎて０℃以下となり、ドレン水が凍結して室内ユニット１８を破損する恐れがある。この時は、室内ファン６３送風量に下限値を設け、この送風量に相当する室内ファンモータ６４回転数がある値以下の場合には圧縮機２１回転数に上限値を設け、この値の範囲で必要な潜熱顕熱熱交換量が得られない場合は、室内ファンモータ６４回転数を上昇させて室内ファン６３送風量を増加させ、蒸発温度が０℃以上となるよう制御してやればよい。また例えば潜熱顕熱熱交換量を制御装置６９および７２だけで制御する場合は、室内ユニット１８と室外ユニット１７の間で情報を伝達する必要がなくなり、室内ユニット１８と室外ユニット１７の間の信号線７３ｂは不要となって、信号線７３ｂの断線や結線不良による動作不良を防止することができる。また図２１では、第２の演算装置７４を室内ユニット１８内に設置する例を示したが、室外ユニット１７内に設置しても良い。この時例えば、潜熱顕熱熱交換量を制御装置６８および７０および７２だけで制御する場合は、第１の演算装置６７にて推算された室内の潜熱顕熱負荷の情報や、室内ファン６３の現状の回転数、および第２流量制御弁１０の弁開度の情報が、信号線７３ａ、７３ｂを経由して第２の演算装置７４に伝達されて、７３ｃを通って制御信号が伝達され制御装置６８および７０および７２が動作する。すなわち室外ユニット１７から室内ユニット１８への制御信号の戻りがないため、室内ユニット１８内のア

クチュエータがどのような動作状況にあっても（例えば居住者が室内ファン６３の送風量を自由に選択しても）、室内の潜熱顕熱能力を調整することができる。

【００９０】以上に述べた制御方法により、温湿度偏差がゼロまたは所定の値以内となった場合には、現在の運転を続行すればよい。このようにこの実施の形態では、冷房再熱除湿運転時の潜熱顕熱負荷に応じて、各種アクチュエータを制御することにより、部屋内の温湿度環境を居住者の好みに応じて最適な状態に制御することができ、なおかつ室内ユニット１８の構造を図１のように実施しているので、吹出し空気も温度ムラのない状態となり、快適な室内環境を得ることができる。合わせて第２流量制御弁１０に多孔質透過材を用いてやれば、冷媒流動音が低減し、より快適な室内環境が達成される。なお、暖房除湿運転時も、前述した冷房再熱除湿時と同様の方法で各種アクチュエータを制御してやれば、快適な室内環境を得ることができる。

【００９１】実施の形態１０．本発明の第１０の実施形態による空気調和機について説明する。冷媒回路図は図２と同様で、室内ユニット１８の構成は図１と同様である。冷媒としては可燃性であるＲ２９０またはＲ３２を用いている。そして第１流量制御弁２４または第２流量制御弁１０、またはその両方の流量制御弁に全閉機能を備えるとともに、冷媒漏れを検知する手段（図示せず）を備え、空調機運転中や停止中に冷媒漏れを検知した場合にはこれら流量制御弁を全閉する手段（図示せず）を備えたことを特徴とする。これにより冷媒回路内に冷媒を封止することにより室内への冷媒漏れを防止し、可燃性冷媒を用いた空気調和機での安全性を確保することができる。

【００９２】なお、以上実施形態１から１０に述べた空気調和機においては、冷凍機油としては、ＨＣＦＣやＨＦＣ、ＨＣ冷媒や自然冷媒などの上述した冷媒に対して非相溶性または難溶性の冷凍機油、もしくは相溶性の冷凍機油であっても、アルキルベンゼン系、鉱油系、エステル油系、エーテル油系、フッ素油系など、どんな冷凍機油についても、その効果を達成することができる。

【００９３】なお、以上実施形態１から１０に述べた空気調和機においては、室外ユニット１７と室内ユニット１８が１台ずつである空気調和機の例を示したが、室外ユニット１７が１台で室内ユニット１８が複数台である空気調和機機においても、その効果は達成される。を冷凍機油としては、ＨＣＦＣやＨＦＣ、ＨＣ冷媒や自然冷媒などの上述した冷媒に対して非相溶性または難溶性の冷凍機油、もしくは相溶性の冷凍機油であっても、アルキルベンゼン系、鉱油系、エステル油系、エーテル油系、フッ素油系など、どんな冷凍機油についても、その効果を達成することができる。

【００９４】本発明は、以上に説明したように構成されているので、圧縮機、室内熱交換器、第１流量制御弁、室外熱交換器を備え、室内熱交換器を室内機の前面から背面にかけて送風機を囲むように配置した空気調和機において、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードにて、この再熱器と蒸発器が熱的に遮断されているとともに、前記室内熱交換器の正面もしくは前面上段斜め部を再熱器として作用させ、前記室内熱交換器前面下部と前記室内熱交換器背面下部が蒸発器として作用するような冷媒流路を構成したので、加熱された空気と冷却除湿された空気とが送風機により効率良く混合されるので、吹き出される空気は、吸込空気と比較して温度低下がなく除湿された空気となり、しかも空気に温度ムラがなく吹き出されるため、快適な室内環境を作ることができる。また、吹出し空気とともに吹出口から露が吹き出してしまうといった、信頼性上の問題点を解消できる。また、蒸発器となるそれぞれの熱交換器下部にドレンパンを設置することで、熱交換器を伝って除湿した露を直接回収することができるので、信頼性を確保することができる。

【００９５】また、前述再熱器への冷媒流入配管が室内熱交換器への吸込空気流れの上流側に設置し、前述蒸発器への冷媒流入配管が室内熱交換器への吸込空気流れの上流側に設置したので、加熱された空気と冷却除湿された空気とがさらにより効率良く混合され温度ムラがなく吹き出されるため、快適な室内環境を作ることができる。

【００９６】また、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードの際、再熱器の冷媒流れ上流側に熱的に遮断された補助熱交換器を備えたので、再熱熱交換器容量が拡大して再熱熱交換量が増加し、室温低下を防ぎながら再熱除湿する能力制御範囲を大きくすることが可能となる。また、室内ユニット内の空隙スペースを有効に活用することができ、室内ユニットのコンパクト化も可能となる。また通常暖房運転時の室内熱交換器能力を向上させることができる。

【００９７】また、前記補助熱交換器を前記再熱器の空気流れ風上側に設置したので、温度が低い空気と対向して冷媒が流れ、熱交換性能をより向上させることができる。

【００９８】また、前記補助熱交換器の通風抵抗を他の熱交換器より小さくしたので、通風側の圧力損失の増大を抑えながら熱交換性能を向上させることができる。

【００９９】また、冷媒としてＲ４１０ＡまたはＲ３２またはＲ２９０を用いたので、オゾン層破壊防止や地球温暖化に役立つことができる。

【０１００】また、冷媒としてＲ４１０ＡまたはＲ３２またはＲ２９０を用い補助熱交換器の冷媒流路を一系統

としたので、オゾン層破壊防止や地球温暖化に役立つことができ、通常暖房運転時の室内熱交換器能力をより向上させることができる。

【０１０１】また、冷媒としてＲ４１０ＡまたはＲ３２またはＲ２９０を用い、圧縮機、四方弁、室内熱交換器、第１流量制御弁、室外熱交換器を備えた空気調和機において、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる除湿運転モードにて、空気流れ上流側が蒸発器、空気流れ下流側が再熱器として作用するような冷媒流路を構成したので、オゾン層破壊防止や地球温暖化に役立つことができ、加熱された空気と冷却除湿された空気とが送風機により効率良く混合されるので、吹き出される空気は、吸込空気と比較して温度低下がなく除湿された空気となり、しかも空気に温度ムラがなく吹き出されるため、快適な室内環境を作ることができる。また、吹出し空気とともに吹出口から露が吹き出してしまうといった、信頼性上の問題点を解消できる。また、蒸発器となるそれぞれの熱交換器下部にドレンパンを設置できるので、熱交換器を伝って除湿した露を直接回収することができるので、信頼性を確保することができる。

【０１０２】また、室内熱交換器を分割しその間に第２流量制御弁を設け、第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる除湿運転モードにて、前記再熱器と蒸発器を熱的に遮断することを特徴としたので、より多くの再熱熱交換量と蒸発熱交換量を確保することができる。

【０１０３】また、前述再熱器への冷媒流入配管が室内熱交換器への吸込空気流れの上流側に設置し、前述蒸発器への冷媒流入配管が室内熱交換器への吸込空気流れの上流側に設置したので、加熱された空気と冷却除湿された空気とがさらにより効率良く混合され温度ムラがなく吹き出されるため、快適な室内環境を作ることができる。

【０１０４】また、再熱器の上方には再熱器を配置したので、蒸発器から再熱器への露の滴下を防止しながら再熱側と除湿側の比率を適度に保つことができ、加熱された空気と冷却除湿された空気とがさらにより効率良く混合され温度ムラがなく吹き出されるため、快適な室内環境を作ることができる。

【０１０５】また、前記室内熱交換器を熱的に分割しその間に流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる除湿運転モードの際、再熱器の冷媒流れ上流側に熱的に遮断された補助熱交換器を備えたので、再熱熱交換器容量が拡大して再熱熱交換量が増加し、室温低下を防ぎながら再熱除湿する能力制御範囲を大きくすることが可能となる。また、室内ユニット内の空隙スペースを有効に活用することができ、室内ユニットのコンパクト化も可能となる。また通常暖房運転時の室内熱交換器能力を向上させることができる。

【０１０６】また、前記補助熱交換器を前記再熱器の空気流れ風上側に設置したので、温度が低い空気と対向して冷媒が流れ、熱交換性能をより向上させることができる。

【０１０７】また、補助熱交換器の冷媒流路を一系統としたので、通常暖房運転時の室内熱交換器能力をより向上させることができる。

【０１０８】また、前記補助熱交換器の通風抵抗を他の熱交換器より小さくしたので、通風側の圧力損失の増大を抑えながら熱交換性能を向上させることができる。

【０１０９】また、圧縮機、室内熱交換器、第１流量制御弁、室外熱交換器を備え、室内熱交換器を室内機の前面から背面にかけて送風機を囲むように配置した空気調和機において、前記室内熱交換器を分割しその間に第２流量制御弁を設けるとともに、この第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる運転モードにて、前記再熱器の熱交換器容量を室内熱交換器の６０～６５％としたことを特徴としたので、広範囲な潜熱顕熱熱交換能力制御範囲を確保することができる。

【０１１０】また、第１流量制御弁もしくは第２流量制御弁の流動抵抗体として、冷媒流れ方向に連通する多孔質透過材を用いたので、流量制御弁を通過する冷媒流動音を大幅に低減することができ、さらに、流量制御弁の回りに遮音材や制振材を周囲に巻きつけるなどの対策も不要でコスト低減となり、さらにこれら他材質が不要となるため、空気調和機のリサイクル性も向上する。

【０１１１】また、第２流量制御弁内に、オリフィスとこの冷媒流れ上流方向、または下流方向、または上下流方向に、オリフィスを挟み込む構造で冷媒流れ方向に連通する多孔質透過材を配置、または多孔質透過材を単独に配置して、流動抵抗体として作用させるとともに、第２流量制御弁をバイパスする冷媒流路と、このバイパス流路を開閉する手段とを備えたので、第２流量制御弁を通過する冷媒流動音が大幅に低減されるとともに、第２流量制御弁の構造が簡略化され、コスト低減を図ることができる。

【０１１２】また、室外熱交換器と第１流量制御弁をバイパスする冷媒流路と、このバイパス流路を開閉する手段を備えたので、再熱除湿運転の能力制御範囲を拡大することができる。

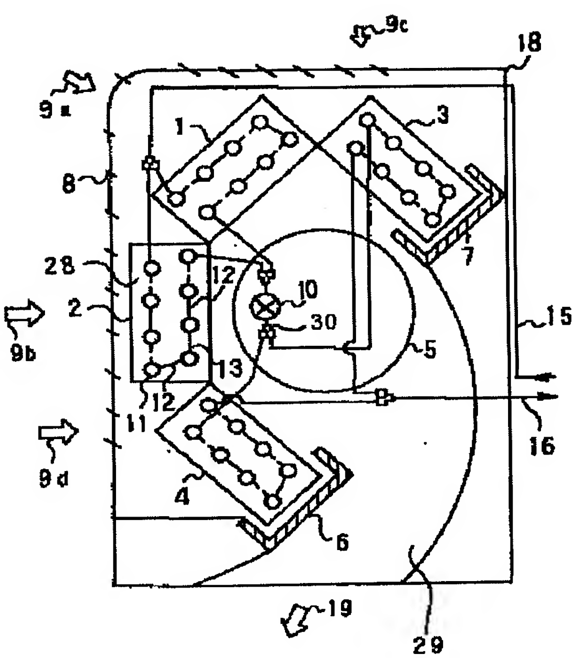
【０１１３】また、除湿運転モードにて第２流量制御弁の入口配管と圧縮機吸入配管とを熱交換させる熱交換器を設けたので、第２流量制御弁を冷媒が通過する際の冷媒流動音を大幅に低減することができる。

【０１１４】また、暖房運転時、高圧液となる冷媒回路上に液冷媒を貯留する容器を設けたので、冷房暖房とも最適な冷媒量にて高効率な運転が可能になるとともに、

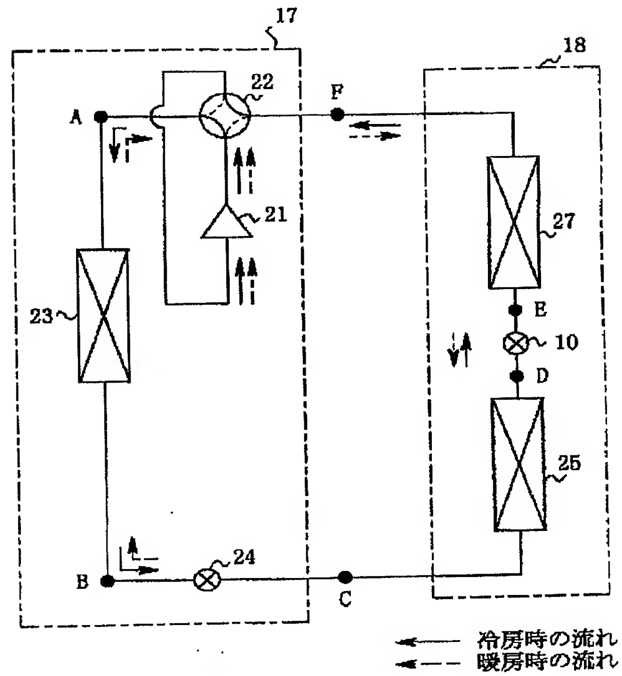
第２流量制御弁を冷媒が通過する際の冷媒流動音を大幅に低減することができる。
【０１１５】また、第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる除湿運転モードにて、室内での潜熱および顕熱空調負荷を検知する手段を備えるとともに、これら空調負荷の検知情報を基に室内熱交換器への送風量を調整する手段を備えたので、室内での潜熱および顕熱負荷に応じて、潜熱および顕熱熱交換量を制御することができる。
【０１１６】また、第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる除湿運転モードにて、室内での潜熱および顕熱空調負荷を検知する手段を備えるとともに、これら空調負荷の検知情報を基に室外熱交換器への送風量を調整する手段を備えたので、室内での潜熱および顕熱負荷に応じて、潜熱および顕熱熱交換量を制御することができる。
【０１１７】また、第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる除湿運転モードにて、室内での潜熱および顕熱空調負荷を検知する手段を備えるとともに、これら空調負荷の検知情報を基に圧縮機回転数を調整する手段を備えたので、室内での潜熱および顕熱負荷に応じて、潜熱および顕熱熱交換量を制御することができる。
【０１１８】また、第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる除湿運転モードにて、室内での潜熱および顕熱空調負荷を検知する手段を備えるとともに、これら空調負荷の検知情報を基に第１流量制御弁の開度を調整する手段を備えたので、室内での潜熱および顕熱負荷に応じて、潜熱および顕熱熱交換量を制御することができる。
【０１１９】また、第２流量制御弁の冷媒流れ上流側を再熱器、冷媒流れ下流側を蒸発器として動作させる除湿運転モードにて、室内での潜熱および顕熱空調負荷を検知する手段を備えるとともに、これら空調負荷の検知情報を基に第２流量制御弁の開度を調整する手段を備えたので、室内での潜熱および顕熱負荷に応じて、潜熱および顕熱熱交換量を制御することができる。
【０１２０】また、冷媒としてＲ２９０またはＲ３２を用い、第１流量制御弁または第２流量制御弁、またはその両方の流量制御弁に全閉機能を備えるとともに、冷媒漏れを検知する手段を備え、冷媒漏れを検知した場合にはこれら流量制御弁を全閉する手段を備えたので、可燃性冷媒に対する室内への冷媒漏洩を防止し、機器の安全性を確保することができる。
【０１２１】
【発明の効果】本発明は、以上に説明したように構成されているので、加熱された空気と冷却除湿された空気とが送風機により効率良く混合されるので、快適な室内環境を作ることができる。
【図面の簡単な説明】
【図１】 本発明における第１の実施形態における室内ユニットの構成を表す図である。
【図２】 本発明における第１の実施形態における冷媒回路図である。
【図３】 本発明における第１の実施形態における冷房再熱除湿運転時の動作状態を表す特性図である。
【図４】 本発明における第１の実施形態における暖房除湿運転時の動作状態を表す特性図である。
【図５】 本発明における第１の実施形態における室内ユニットの他の構成を表す図である。
【図６】 本発明における第１の実施形態における室内ユニットのさらに他の構成を表す図である。
【図７】 本発明における第２の実施形態における室内ユニットの構成を表す図である。
【図８】 本発明における第２の実施形態における室内ユニットの他の構成を表す図である。
【図９】 本発明における第２の実施形態における室内ユニットのさらに他の構成を表す図である。
【図１０】 本発明における第３の実施形態における室内ユニットの構成を表す図である。
【図１１】 本発明における第３の実施形態における室内ユニットの他の構成を表す図である。
【図１２】 本発明における第３の実施形態における室内ユニットのさらに他の構成を表す図である。
【図１３】 本発明における第４の実施形態における第２流量制御弁の構成を表す図である。
【図１４】 本発明における第５の実施形態における第２流量制御弁の構成を表す図である。
【図１５】 本発明における第５の実施形態における冷媒回路図である。
【図１６】 本発明における第５の実施形態における第２流量制御弁の他の構成を表す図である。
【図１７】 本発明における第５の実施形態における第２流量制御弁のさらに他の構成を表す図である。
【図１８】 本発明における第６の実施形態における冷媒回路図である。
【図１９】 本発明における第６の実施形態における冷房再熱除湿運転時の動作状態を表す特性図である。
【図２０】 本発明における第７の実施形態における冷媒回路図である。
【図２１】 本発明における第７の実施形態における冷房再熱除湿運転時の動作状態を表す特性図である。
【図２２】 本発明における第８の実施形態における冷媒回路図である。
【図２３】 本発明における第９の実施形態における冷媒回路図およびセンサ、アクチュエータの構成図である。
【図２４】 従来の発明における室内ユニットの構成を表す図である。
【図２５】 従来の発明における室内ユニットの他の構

成を表す図である。
【図２６】　従来の発明における第２流量制御弁の構成を表す図である。
【符号の説明】
５：室内送風機
６、７：ドレンパン
１０：第２流量制御弁
１４：補助熱交換器
＊１７：室外ユニット
１８：室内ユニット
２１：圧縮機
２３：室外熱交換器
２４：第１流量制御弁
２５：第１室内熱交換器
２７：第２室内熱交換器
＊　３８：焼結金属

【図１】

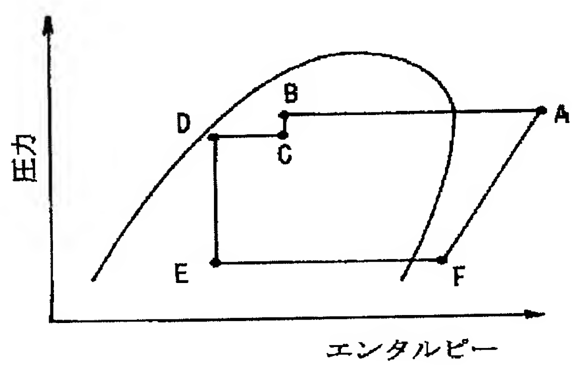


【図２】

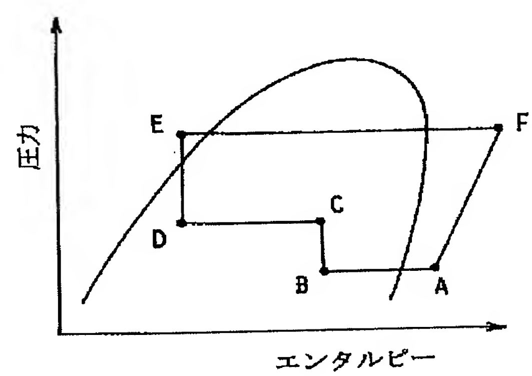


10：第２流量制御弁
17：室外ユニット
18：室内ユニット
21：圧縮機
22：四方弁
23：室外熱交換器
24：電気式膨張弁
（第１流量制御弁）
25：第１室内熱交換器
27：第２室内熱交換器

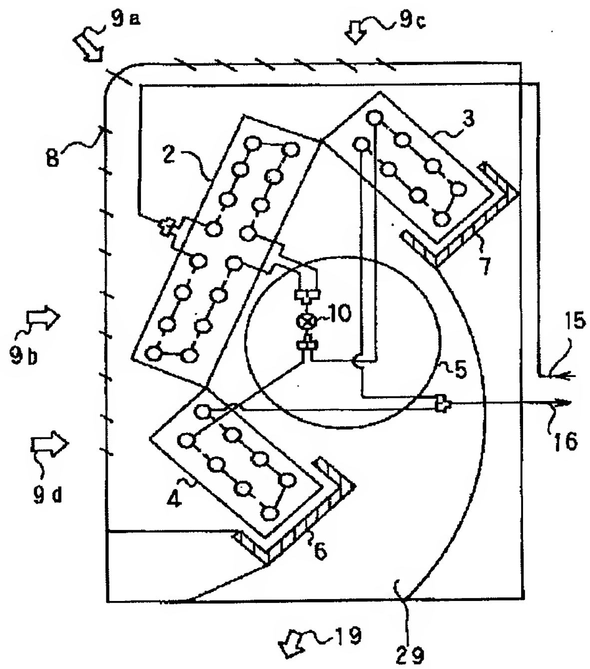
【図３】



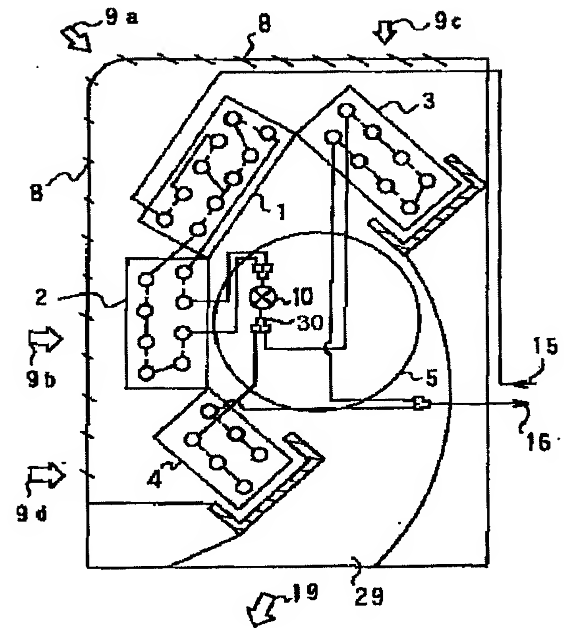
【図４】



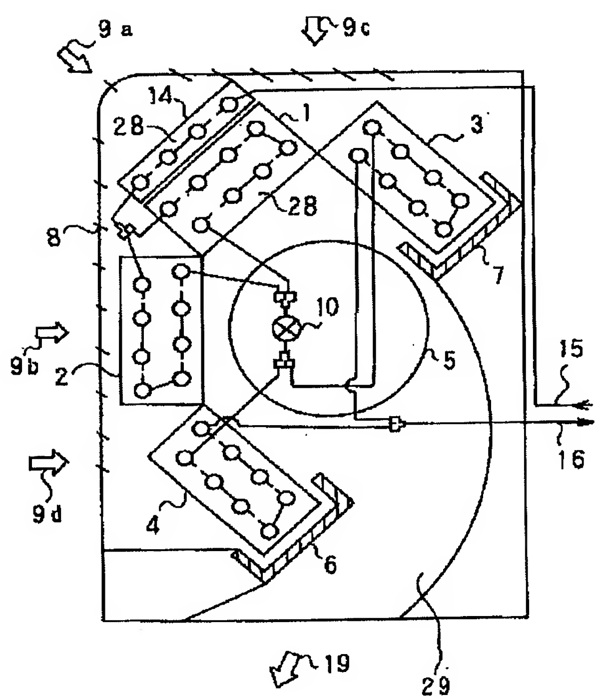
【図５】


9a
9c
8
2
3
7
10
15
9b
5
16
9d
4
6
19
29

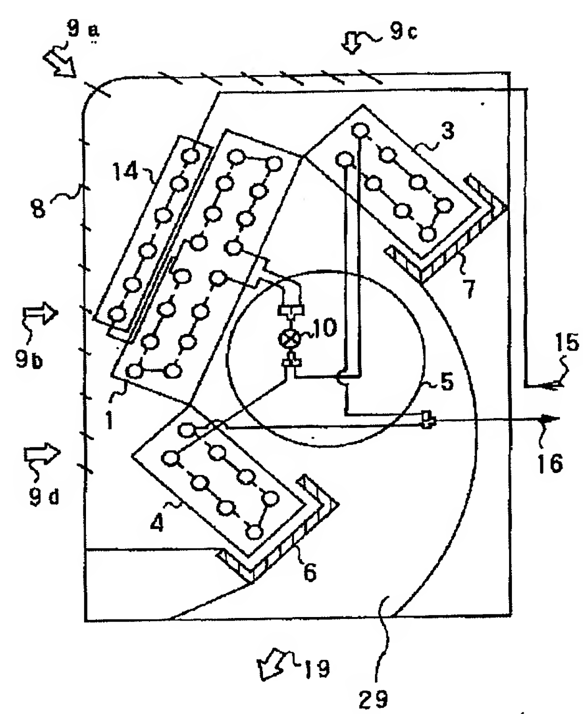
【図６】


9a
8
9c
3
8
1
2
10
30
15
9b
5
16
9d
4
19
29

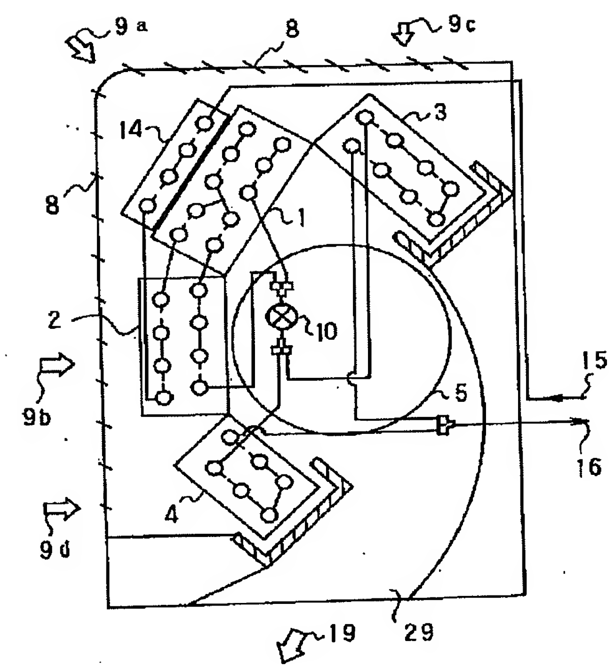
【図７】


9a
9c
14
1
3
28
28
8
7
10
15
9b
2
5
16
9d
4
6
19
29

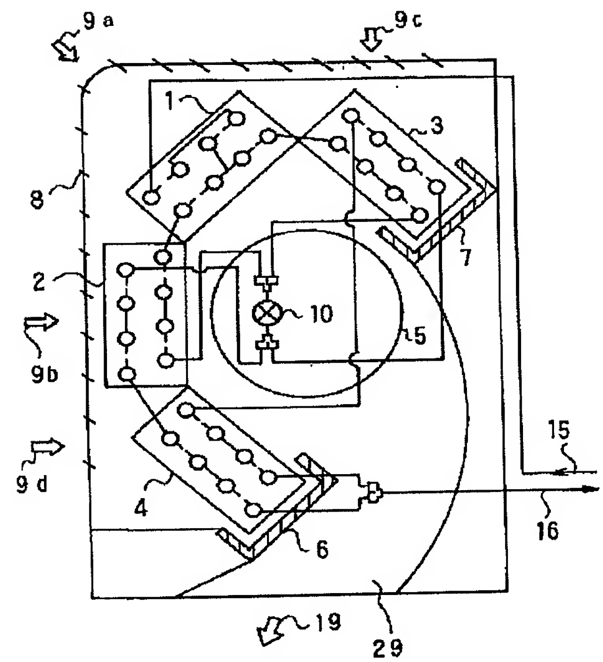
【図８】


9a
9c
3
14
8
7
10
15
9b
5
1
16
9d
4
6
19
29

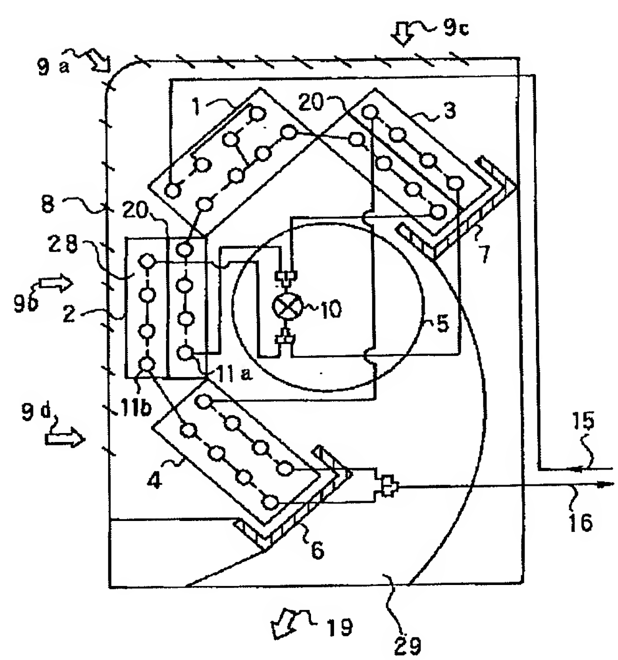
【図９】



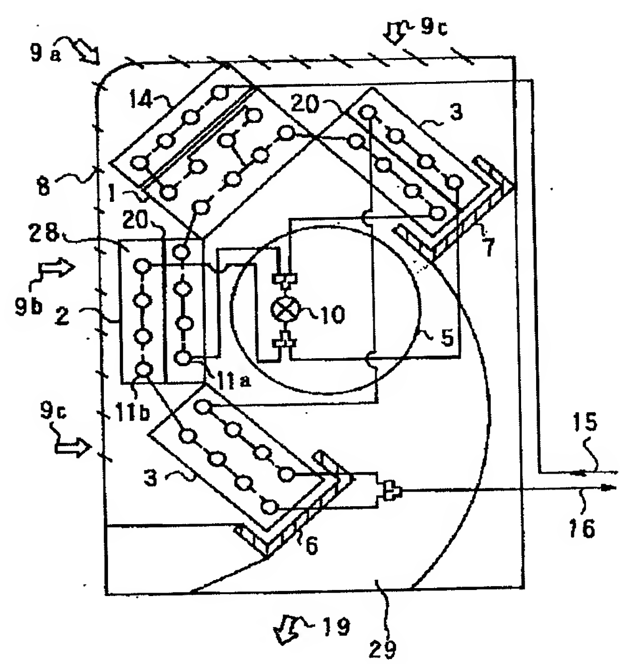
【図１０】



【図１１】

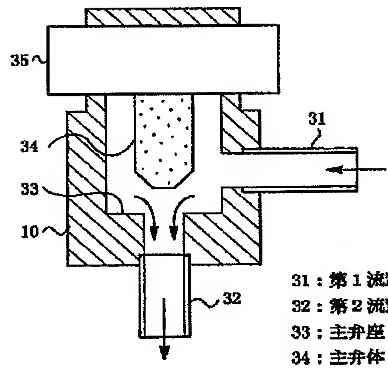


【図１２】



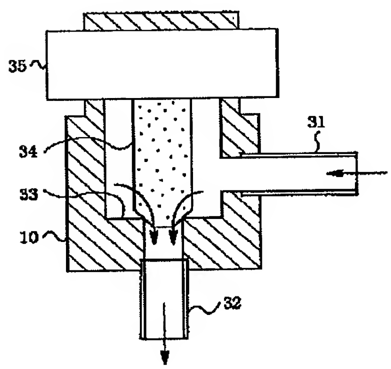
【図１３】

（ａ）

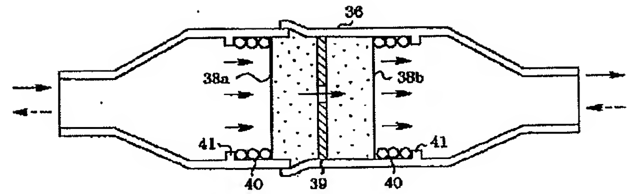


31：第１流路
32：第２流路
33：主弁座
34：主弁体
35：電磁コイル

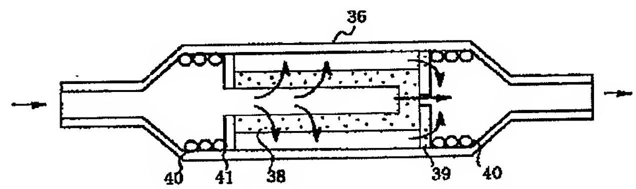
（ｂ）



【図１４】

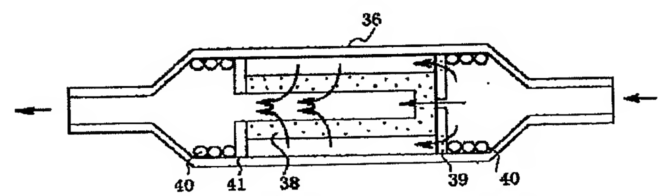


【図１６】

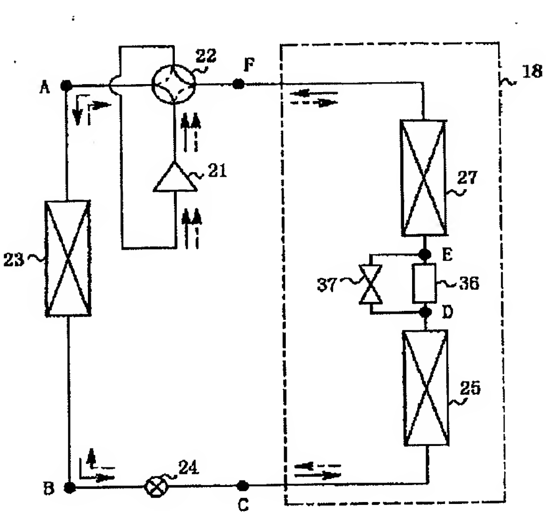


38：焼結金属
39：オリフィス

【図１７】



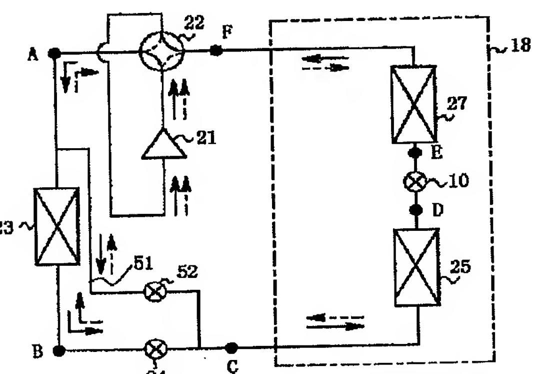
【図１５】



冷房時の流れ
暖房時の流れ

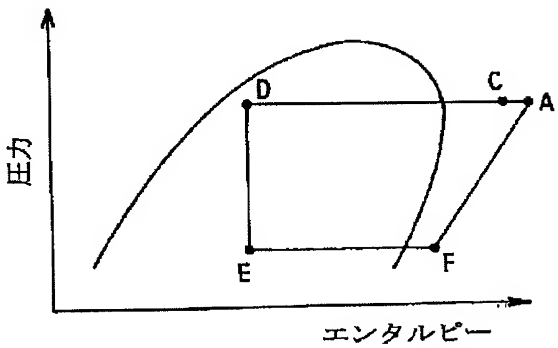
36：絞り装置
37：電磁開閉弁

【図１８】

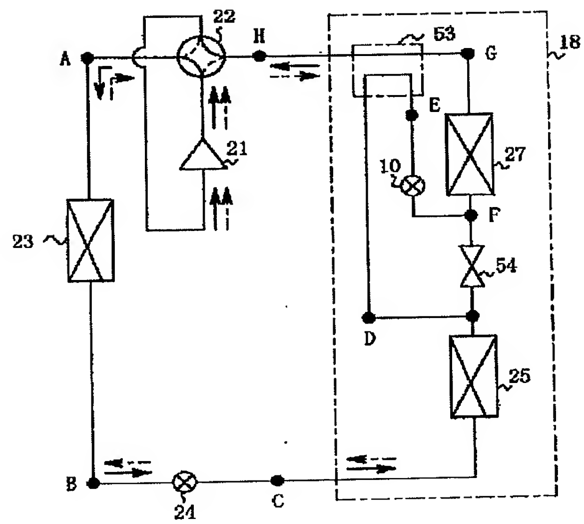


冷房時の流れ
暖房時の流れ

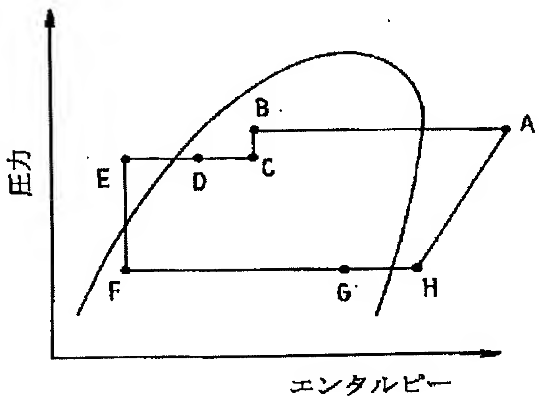
【図１９】



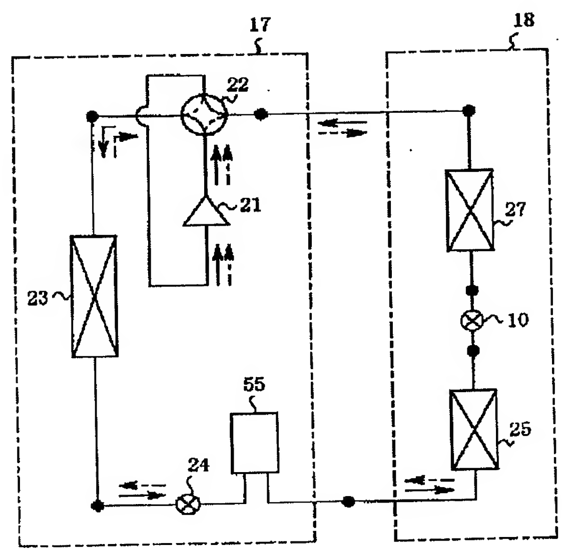
【図２０】



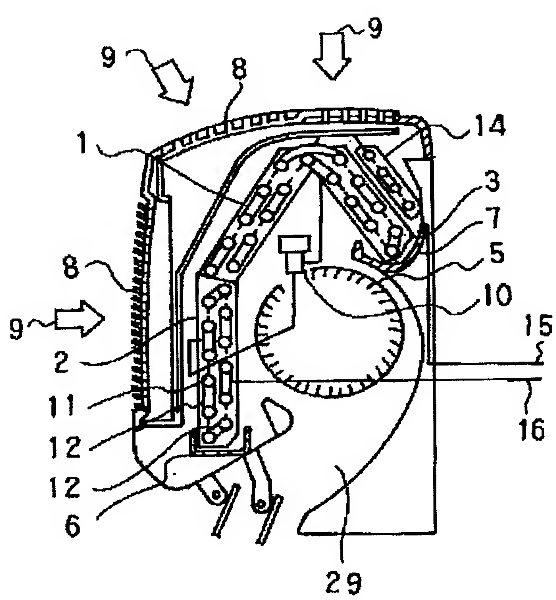
【図２１】



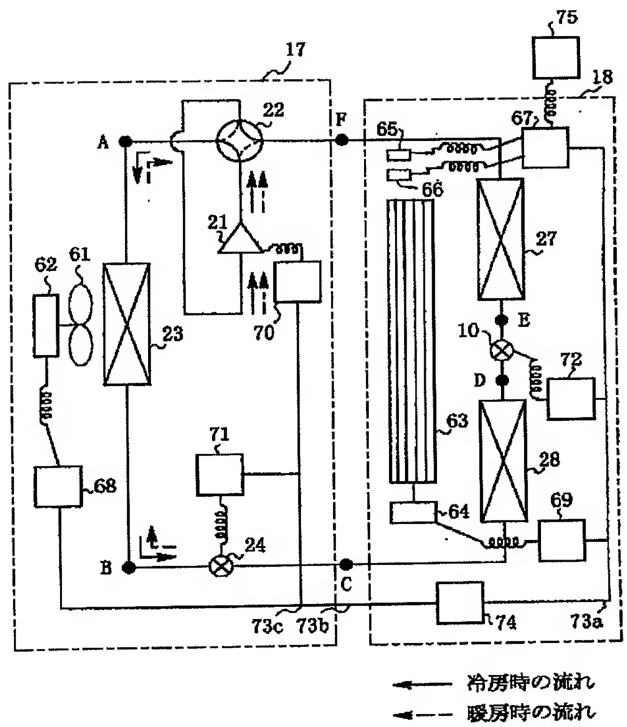
【図２２】



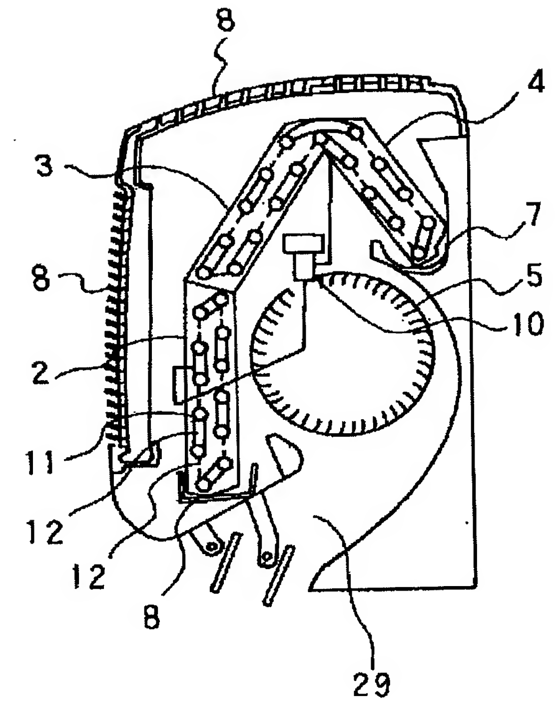
【図２５】



【図２３】


17
18
75
22
A
F
65
67
66
21
27
62
61
23
70
E
10
72
D
63
71
28
68
64
69
24
B
C
73c
73b
74
73a
冷房時の流れ
暖房時の流れ

【図２４】


8
4
3
7
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12
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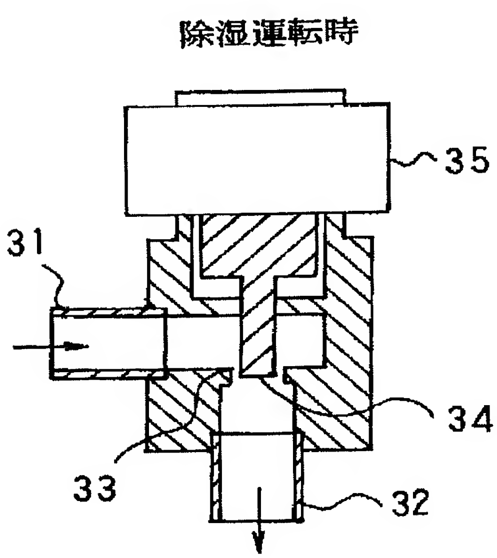
【図２６】


除湿運転時
35
31
34
33
32

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